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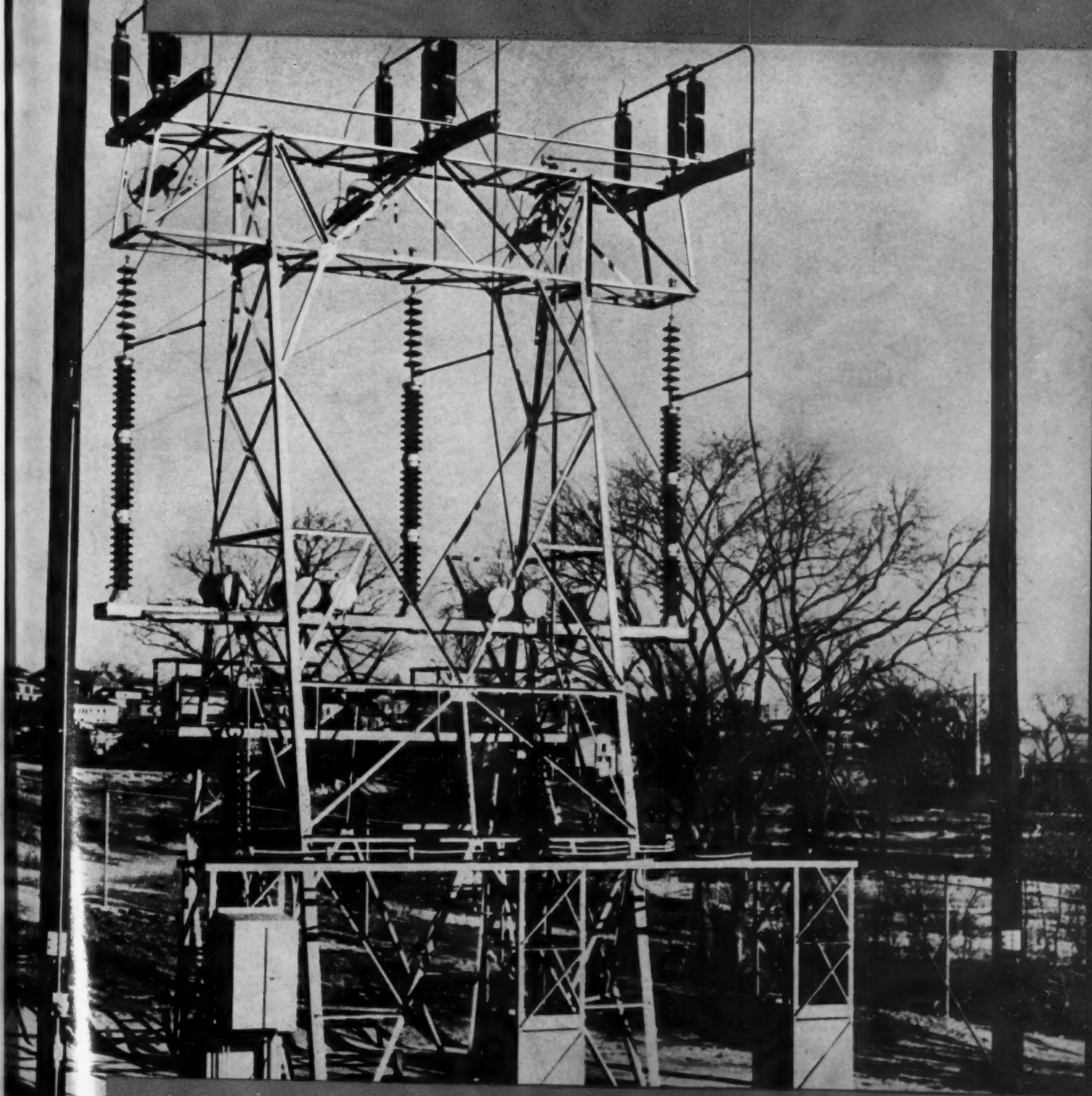
Electrical World

OCTOBER 5, 1940



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October 5, 1940

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JAMES H. McGRAW, Jr.....President
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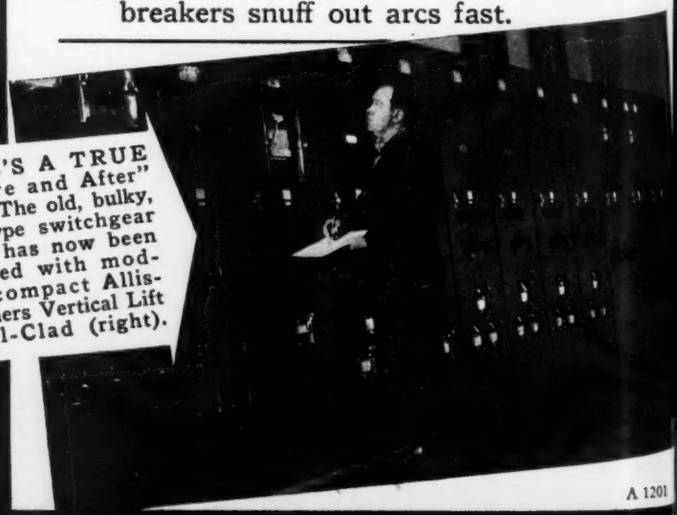

HERE'S A TRUE "Before and After" story. The old, bulky, open-type switchgear (left) has now been replaced with modern, compact Allis-Chalmers Vertical Lift Metal-Clad (right).

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Compliance

Manufacturers who for one reason or another fail to co-operate with the government in furnishing the materials necessary to the execution of our program for national defense may find themselves in trouble. What constitutes non-compliance?

Obviously any manufacturer, or anybody else for that matter, who willfully tries to hinder our preparations for national defense should be prevented from so doing. But what of manufacturers who may have tried to get out of supplying certain equipment to the government because of unfair or restrictive specifications? Are they to be penalized for failure or poor performance on the part of government specifications writers?

One case came to our attention a few days ago, and we presume with the volume of purchases being made that this case is being duplicated many times. A manufacturer of lighting equipment showed us a specification calling for a reflector to be made in accordance with another manufacturer's drawing No. ——, without any "or similar" clause. The only manufacturer who could fill that order quickly and at a favorable price obviously would be the one whose style was specified.

Many other specifications have been written calling for special equipment, either in size, assembly or finish, when standard equipment could have done as good a job, if not better. In every case, however, the special design would take longer to produce.

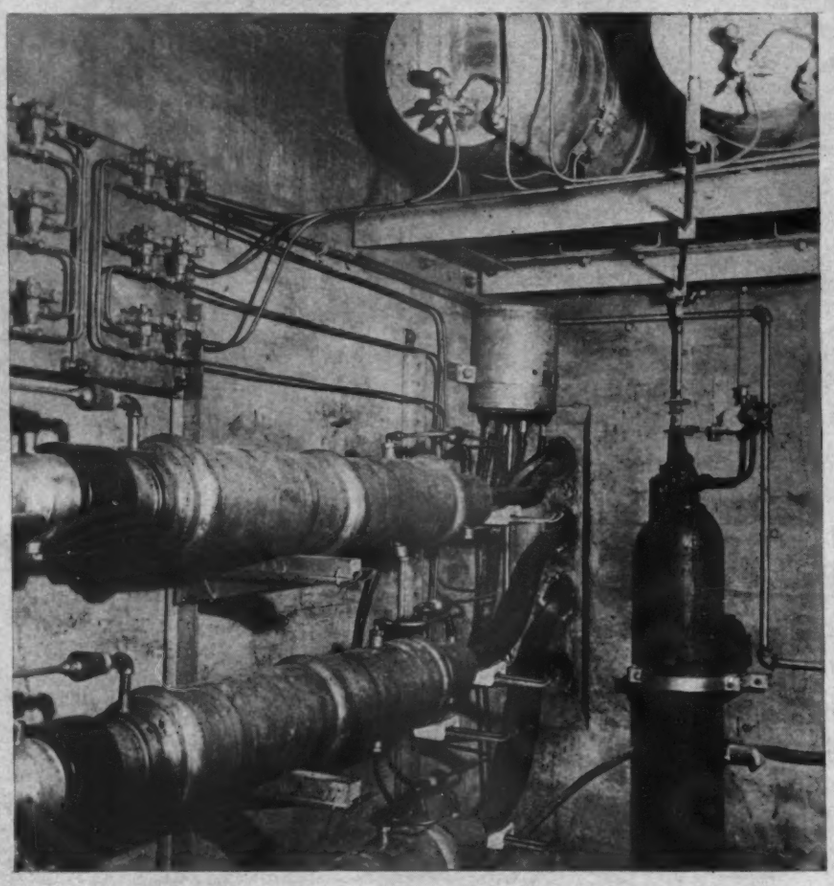
The men in the air corps, ordnance department or other branches of the Army procurement who write these specifications are not sleeping in any bed of roses. Moreover, they are undoubtedly imposed upon by manufacturers' representatives with the mistaken idea that if they can get their special gadgets, style numbers, shapes or finishes incorporated in the specifications they will have the bulge on all their competitors.

In the first place, there is enough defense business for everybody to get his share. But defense business isn't everything. The wise manufacturer knows that when this wave is over he must have other normal production or he won't have any business.

It must also be remembered that standard lines have become standard because they have on the whole performed best. The Army will get for its munitions plants and depots and airplane quarters the best prices, quickest deliveries and best over-all performance if it sticks to manufacturers' standards and stops trying to improve in a few days upon equipment that the producers have been years in perfecting.

Furthermore, every order for special equipment, where standard would have done, takes just so much production time away from some other order that is needed for defense. Thus, specials defeat their own purpose and help to slow up the defense program.

Now, if manufacturers who are offered such specifications neglect to quote, or quote outlandish prices or deliveries, are they guilty of non-compliance? We don't know of any who are doing that, but we do believe that the matter of compliance works both ways.



Inside stop-joint manhole

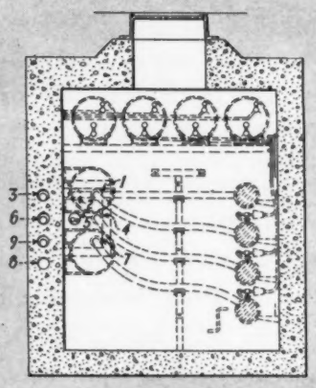
Oil reservoirs at upper right; high-pressure CO_2 container at lower right; bonding transformer at center back; valve panel at upper left; stop joints and insulated section at lower left.

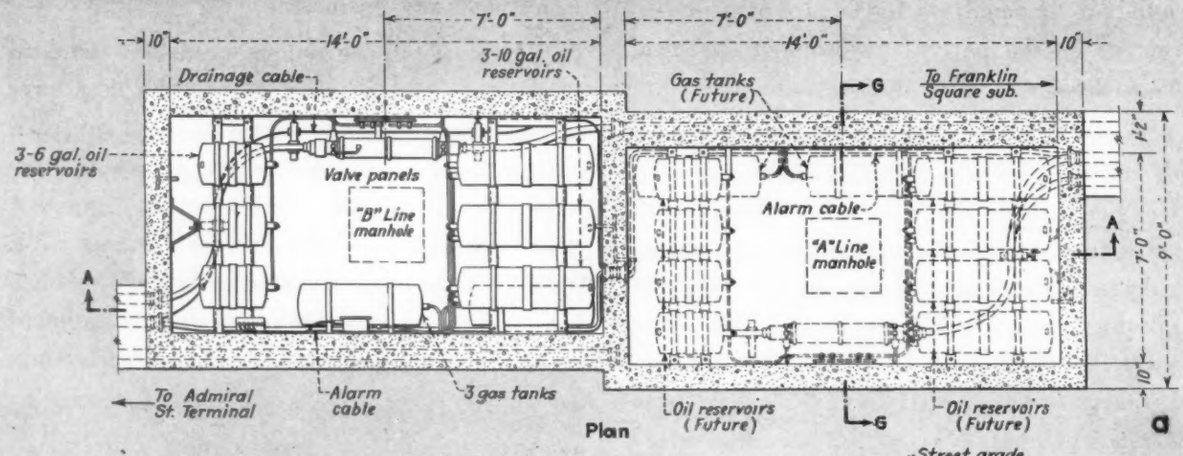
Details of typical stop-joint manhole unit

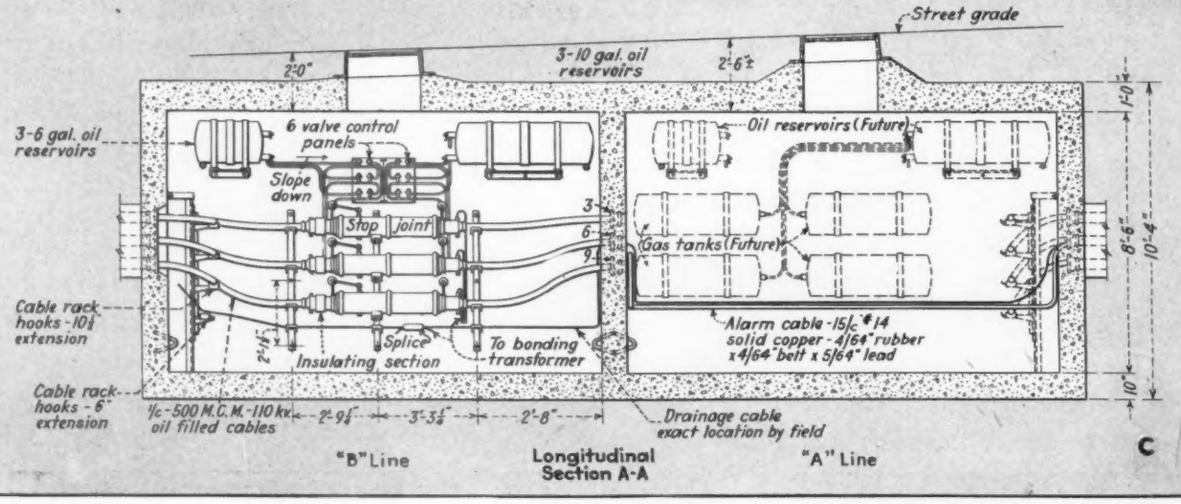
(a) Plan of "B" line manhole for initial circuit (at left); "A" line manhole at right for later circuit. A drainage and control cable duct common to both manholes serves initial and future circuits.

(b) Cross-section of "A" line manhole.

(c) Longitudinal section of complete manhole unit (initial line "B" at left; future line "A" at right).







110-Kv. Cable Tie for High Continuity Service

Design provides for wide segregation of circuits in duct line and double manhole construction — Submarine section included

H. E. CARSON, New England Power Company, Providence, R. I.

NEW ENGLAND'S first 110-kv. cable transmission connects the Franklin Square substation of the Narragansett Electric Company in the heart of Providence with an incoming 110-kv. overhead circuit of the New England Power Association System at Admiral Street in the outskirts of the city, completing a tie of 100,000 kva. nominal capacity between Woonsocket and Providence. Cable construction was required because the last 2 miles of transmission is in the heart of the Rhode Island capital.

The installation provides the virtual equivalent of two independent underground duct lines in a single trench, with further segregation of power circuits by the use of double manhole construction. The initial circuit went into operation last fall and enables the rapidly growing loads of the Narragansett territory to be handled with greater facility and an increased margin of capacity. When conditions require adding a second circuit the system will have two segregated three-phase underground transmissions between the above terminal points, including a short section of submarine cable construction.

Obstructions Encountered

A 110-kv. overhead No. 4/0 "Polarm" line between Woonsocket and Admiral Street, 11¼ miles in length, was built last year as a part of this project. An overhead line of 110 kv. was already in use between the Millbury (Mass.) transmission headquarters of the system and Woonsocket. The extension of this transmission to the heart of Providence therefore involved only a little over 13 miles of construction.

The cable installation comprises about 14,000 circuit-ft. of G.E. single-conductor, oil-filled construction, including about 700 ft. of submarine section under the Providence River near Franklin Square. As the route lies through the oldest part of the city, many obstructions and unusual conditions were encountered. In one case it was necessary to build a pair of manholes 17 ft. deep to obtain proper duct drainage, and in another instance a combination of sewer, gas and water pipes required ducts 10 ft. below the surface.

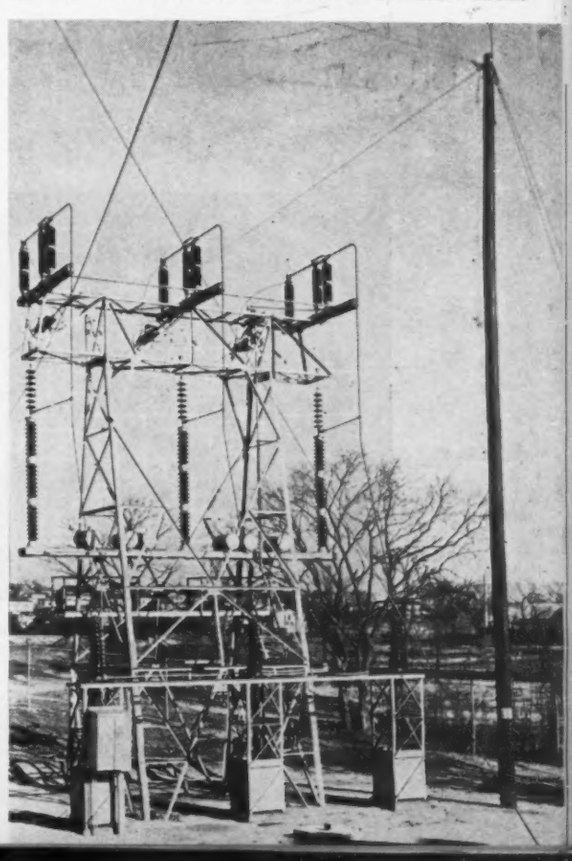
Two manholes have been provided at each location, one for each 110-kv. circuit of the ultimate installation. These are built in units with complete separation of the high-tension transmissions. The underground conduit line consists of nine 4-in. fiber ducts with 3 x 3 formation. Three ducts are assigned to the phase-conductor cables of the initial 110-kv. circuit, with a fourth spare duct for this circuit. A similar arrangement is provided for the second or future transmission circuit. The ninth duct, carrying drainage and control cable facilities, serves the first power circuit initially and both transmission circuits ultimately. This has been carried through both manholes of each pair, and it is the only duct common to both manholes. In other words, each manhole is traversed by five ducts, three being assigned to transmission, the fourth being a spare and the fifth carrying the drainage and control cable.

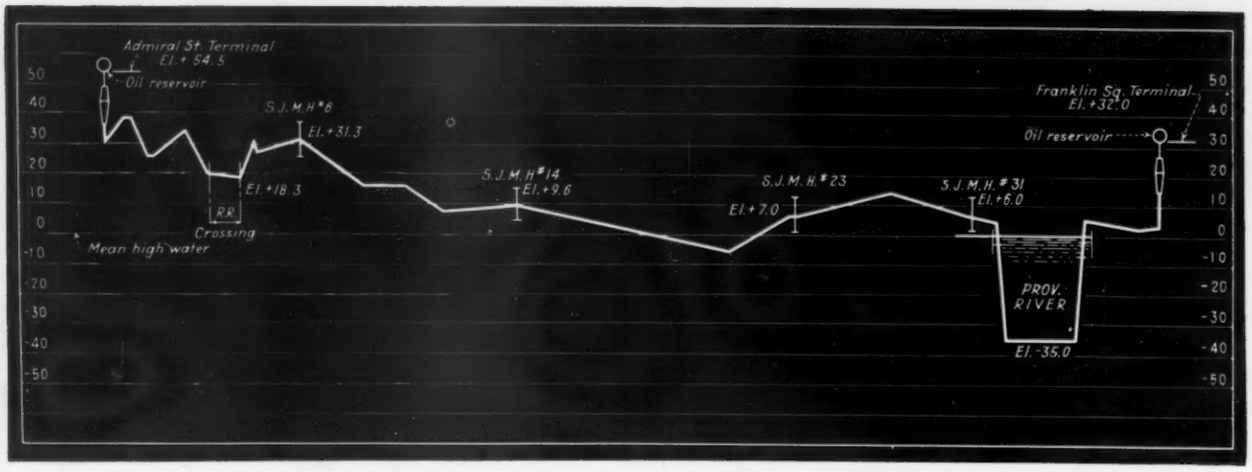
This arrangement permits, if later desired, pulling in a spare phase conductor per circuit with minimum loss of time in case of trouble, in addition to the benefits of separation provided between the two circuits.

The tie required the construction of 32 double manholes, four of which were for stop joints and 28 for normal joints. Normal joint manholes are 6 x 12 x 6 ft. 6 in. inside. Stop joint manholes are 7 x 14 x 8 ft. 6 in. in interior dimensions.

In the initial installation the phase conductors are located one above the other in a row of three at one side of the duct group, the drainage and

TERMINAL STRUCTURE at Admiral Street, where cable connects with Woonsocket-Providence overhead circuit





PROFILE of cable run with locations of stop-joint manholes

control cable duct being in the center of the group of nine. Above and below the drainage and control cable duct are the two spares, and at the other side of the conduit are the three vertical ducts reserved for the second power circuit. This arrangement provides for maximum separation between the two 110-kv. circuits, aids heat dispersal from the outside tier of ducts for each circuit, places the spare ducts in the middle of the structure and the drainage and control duct in the center.

No ducts were necessary in the submarine section and no drainage and control facilities were carried under the river. A landing manhole was built on each shore without cable joints at these points. To facilitate rapid restoration of service in case of trouble a spare submarine cable carrying one phase conductor was laid across the river at the time of installation of the initial circuit. The cable is laid about 35 ft. below mean high water.

The requirement of 100,000 kva. nominal capacity for the initial circuit made it necessary to use 500,000-circ.mil cable for the main run underground. After considering all types of cable available for this class of service we selected the single-conductor, oil-filled type, with a half-inch hollow core, 0.48 in. of paper insulation and 8/64-in. lead sheath for the major part of the circuit. The outside diameter is only $2\frac{1}{4}$ in. The submarine section, which is armored, is about $3\frac{1}{2}$ in. in outside diameter.

Oil Pressure

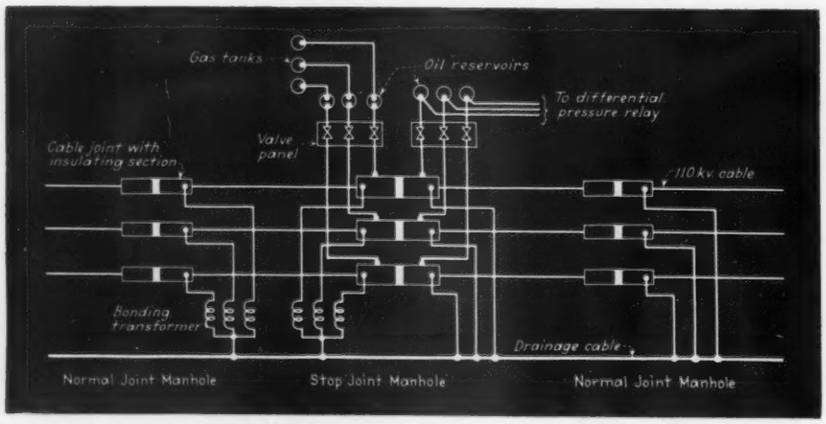
In the installation and use of this oil-filled cable the maximum permissible oil pressure with the normal lead sheath is 15 lb. per sq. in. The minimum allowable oil pressure for the duct section lengths used is about 6 lb. per sq.in., which is necessary to overcome the friction in the hollow core as the distance from the pressure reservoir increases. To maintain the oil pressures within the above limits the cable was divided into five sections of roughly 3,000 ft. each by stop joints located at four points as shown on the profile. Each stop joint section has a separate oil supply, the joints preventing intersectional movement of oil.

Oil pressure is supplied either by gravity or by gas tanks filled with CO_2. An artificial head is produced in the latter case by exerting pressure on a flexible oil container. Gravity feed is used where the change in elevation of the duct line permits, but on the more level sections artificial means of obtaining pressure are required. For the normal lead thickness of $\frac{1}{8}$ in. the maximum allowable difference between the oil supply reservoir or container and the lowest part of the cable in that section is 37.5 ft. In one section of the run, under a railroad, an additional $\frac{1}{64}$ in. of lead thickness was required because the elevation difference between this point and that of the container at Admiral Street exceeded the 37.5-ft. maximum.

In the submarine section the external water pressure is in opposition to the internal oil pressure. Therefore the difference in elevation was not a critical factor. In this section the head was figured from the reservoirs at Franklin Square to the water edge at mean low tide, which was 36.7 ft., but due to the frequency of exceptionally low tides (sometimes as much as 5 ft. below mean low tide) it was deemed advisable to add $\frac{1}{64}$ in. of lead in this section to guard against bulging the lead at the water line.

Calculations show that 500 amp. will produce a sheath potential of 12 volts in a 430-ft. section. Since 12

[*Continued on page 124*]



OIL CONNECTIONS at stop joint manhole, with wiring for differential pressure relay, alarm and drainage cable

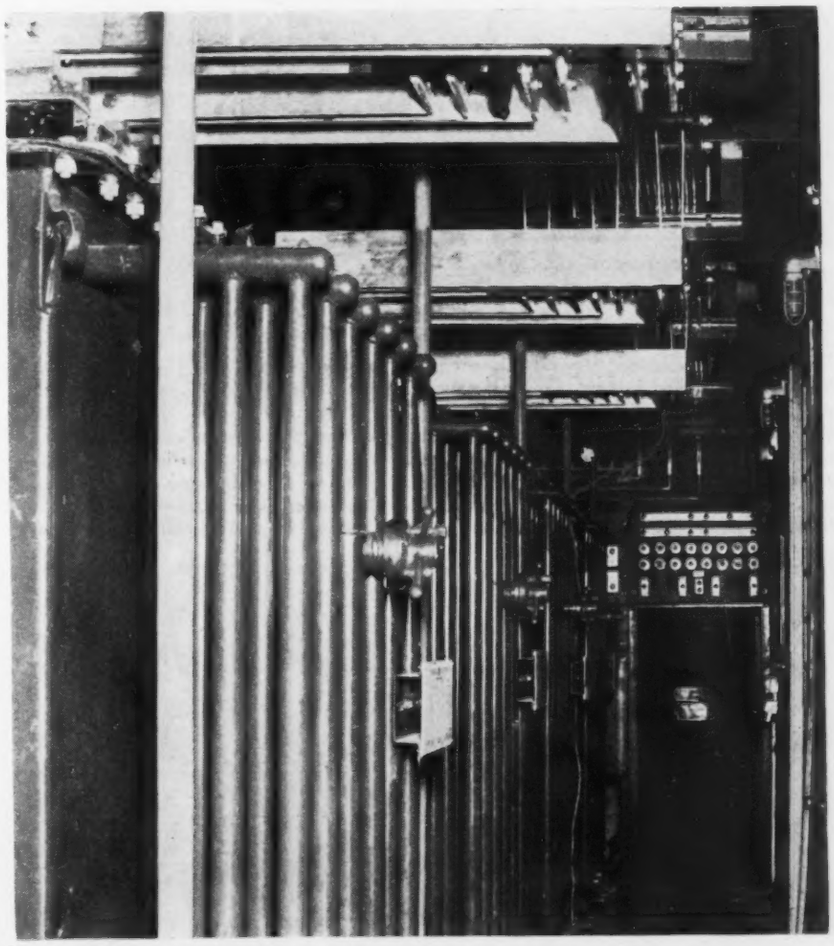
Interlaced Bus Design Solves Space Problem

Evolved bus for industrial customer provides 85 per cent increase in current capacity, 90 per cent decrease in reactance drop, and 25 per cent reduction in the space required for the cross-section area without sacrificing strength

GEORGE E. TENNANT, Engineering Department, Central New York Power Corporation, Syracuse

AN INCREASE of 85 per cent in current capacity and a 90 per cent reduction in reactance drop were provided by the adaptation of the interlaced type of bus to a design problem presented by one of our industrial customers. Space available for the new bus was limited, too; the evolved design furnishes a reduction in the space required for the cross-section area of almost 25 per cent without sacrificing mechanical strength.

One of the industrial customers involved in our recent 2.3-kv. to 4-kv. conversion program had a four-wire 225-volt delta, 130-volt wye secondary distribution system supplied from the 2,300-volt primary service through 2,300 to 260/130-volt delta-wye transformer banks. Nearly all the three-phase power banks on our 2,300-volt system are connected delta-delta and the normal conversion practice is to wye the 2,300-volt primary coils. In this case good operating practice dictated the purchase of new 4,000-volt primary transformers to avoid the unstable wye-wye connection. This decision was reached after the possibility of placing this customer on some other delta primary supply had been eliminated.

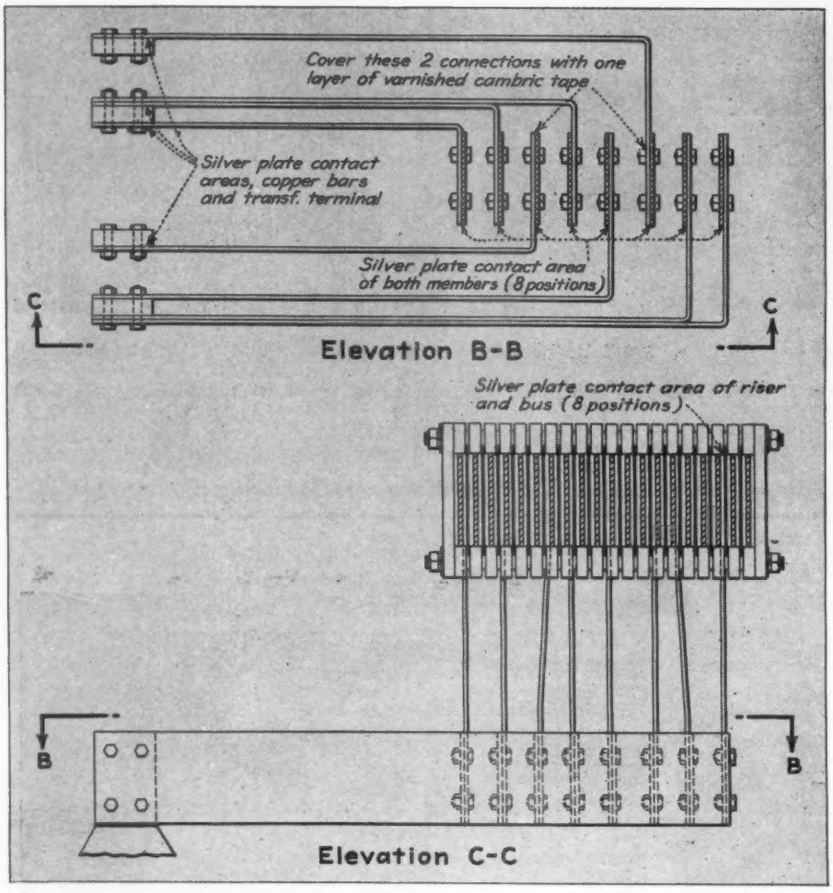


FOUR TRANSFORMERS (883 kva., 4,000 to 260/130 volts) with special arrangement of radiators meet space limitations of industrial vault and provide spare unit (secondary side shown)

Spare Transformer Provided

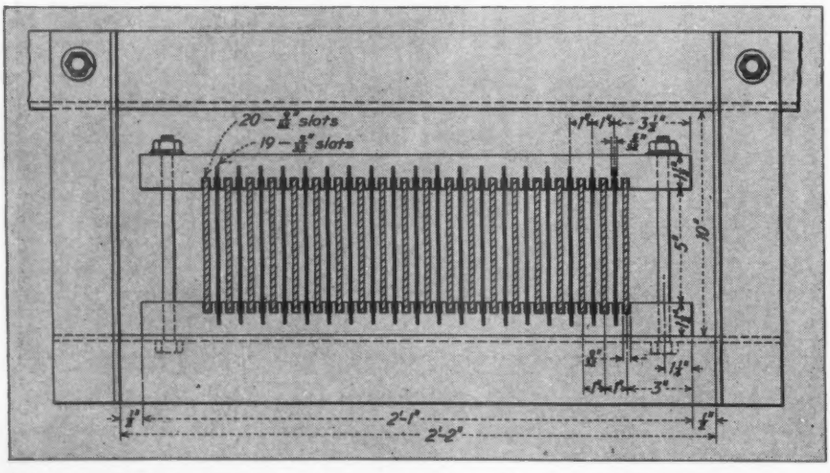
Since this new 4,000 to 260/130-volt transformer bank would not match our stock, it was decided to provide as much capacity for future load growth as the physical limitations of the transformer house would allow. Investigation showed that four 833-kva. units with a special arrangement of radiators would meet the space requirements and provide a bank of 2,500-kva. capacity with a spare unit. Full load on this bank would produce a secondary current of 6,500 amp., and the problem was to redesign the existing secondary bus for the additional capacity in about the same space.

The existing bus consisted of three $\frac{1}{4}$ x 6-in. copper bars with $\frac{1}{4}$-in. spacing for each phase and a single $\frac{1}{4}$ x 6-in. copper bar for the neutral. These bars were supported


Cover these 2 connections with one layer of varnished cambric tape
Silver plate contact areas, copper bars and transf. terminal
Silver plate contact area of both members (8 positions)
C
C
Elevation B-B
Silver plate contact area of riser and bus (8 positions)
B
B
Elevation C-C

CROSS-SECTION of interlaced bus design near support

Twenty 1/4 x 6-in. copper busbars—six per phase and two for the neutral—are held within 9/32-in. slots milled in two 1½ x 3-in. micarta plates, ends of which are bolted to supporting angle extending from opposite walls of transformer house. Plates also have 5/32-in. slots to hold 1/8 x 7-in. micarta separators centered between busbars at support and along bus span between supports. Separators assure phase separation between bars along 5-ft. 3-in. span and, with the ½-in. extension above and below bus, practically eliminate possible bus short by contact of conducting materials in these directions. Note that natural air circulation is not hindered in this method of phase isolation



CLAMPING ARRANGEMENT used to connect ¼ x 6 in. copper bar transformer leads to bus at point midway between bus supports

Clamp consists of 10 1/16 x 10 1/16 x ¾-in. steel plates with four ¾-in. steel rods threaded on each end for steel nuts. Spacers to keep busbars in line consist of 5/16-in. micarta plates arranged to give contact pressure between proper phase bar and transformer lead bar. Spacers are held in place by 25/32-in. inside diameter x 1-in. outside diameter micarta tubing and sections of 1 1/32-in. inside diameter x 2-in. outside diameter micarta tubing on clamp rods. Bus splice clamp is essentially the same with proper space plates.

in a vertical position on class 3 insulators without side bracing. This design provided an estimated capacity of 3,500 amp., based on a 30 deg. C. rise over an ambient of 40 deg. C. With a phase separation of 12 in. the accompanying reactance drop of this arrangement was estimated at 0.38 volt per foot—rather high for approximately 60 ft. of bus run from the transformer secondary to the customer's distribution bus.

Maximum short-circuit current with the new 2,500-kva. bank was calculated at 115,000 amp. for a phase-to-ground fault, 100,000 amp. for a three-phase fault and 86,000 amp. for a phase-to-phase fault. Under these limitations, if the existing type of bus support was used, it would require a class 7 insulator at a 36-in. phase separation to withstand the mechanical stress accompanying the maximum bus short. With the new bank this 36-in. spacing could not be obtained. Even if sufficient side bracing was used to cut down the phase separation to 17 in. the estimated reactance drop would be 0.78 volt per foot.

If ¼ x 6-in. copper bars were to be used in the existing phase arrangement it would require at least eight bars per phase arranged in a hollow square, with 2¾-in. spacing vertically and horizontally between each pair of bars. If the bars were to be discarded a 7 x ½-in. ventilated copper square would provide the capacity required. In either case the necessary side bracing would make a rather costly design, and on a 20-in. phase spacing the estimated reactance drop would still be 0.28 volt per foot.

Interlaced Bus Adopted

An investigation of the interlaced type of bus showed distinct advantages in this particular application and it was decided to use ¼ x 6-in. copper bars placed vertically and spaced on 1-in. centers. Calculation showed that six bars per phase, with two bars for the neutral, would meet the current-carrying requirements without taking the copper temperature above 70 deg. C., and, at the same time, would reduce the reactance drop to 0.04 volt per foot. With the co-operation of representa-

[*Continued on page 127*]

Diesel Engine Operating and Outage Data

Five-year data on loading, availability, specific causes of outage, maintenance labor for 84 units in 27 plants where operating conditions are favorable to engine performance

LEE SCHNEITTER, Diesel Engineer, Ebasco Services, Inc., New York*

PUBLISHED DATA on internal combustion-engine plants often give incomplete information about the causes of outages, the cost of repairs and upkeep and their relation to over-all cost of production. For this reason a five-year survey was conducted by the author to provide an authentic analysis of these costs in greater detail. It is hoped that this supplementary information will add to the value and significance of the more commonly available information about operating costs and economies. Information is presented in a five-year summary in the belief that it is more indicative of what can be expected over a period of years than segregation into yearly experience would be.

Maintenance Costs

There are 27 plants represented in the survey. One is an industrial installation, one a municipal plant and 25 are public utility plants. They embrace 84 engine units. The total installed capacity at the end of 1937 was 66,575 engine-hp. (46,036 kw. generator nameplate rating at 0.8 p.f.). The smallest unit is 100 hp. and the largest is 3,750 hp. Engines are all relatively low in speed; *i.e.*, 120 to 360 r.p.m. Plants covered in the tabulations are considered to be well supervised and, on the whole, represent better-than-average operating conditions. Arithmetic averages (unweighted) are cited in all the tables herewith. Table I shows detailed data on plants and engines.

Average maximum hour, annual load factor and labor requirements are shown (Table II) to have increased when output was resumed after the low period of 1933-34. Certain of the plants added units in the same rising period; this will be shown later to have had an effect on the respective availability factors. From Table II it will be seen that annual labor per plant was 14,794 man-hours and average annual cost of materials and parts per plant for

Table I—Analysis of Plant and Engine Data

Year	1933	1934	1935	1936	1937	5-Year Average
Plant Data						
Number reported	21	24	25	24	24	24
Total rated capacity (b.hp.)	35,195	47,160	59,250	57,330	60,645	51,916
Total rated capacity (kw.)	24,106	32,386	41,006	39,906	42,150	35,911
Engine Data						
Rating, average (b.hp.)	617	665	790	785	830	737
Rating, average (kw.)	423	455	547	545	576	509
Units installed (No.)	57	71	75	73	73	70
Units per plant, average (No.)	2.7	3	3	3	3	3
Speed, average (r.p.m.)	229	223	220	220	218	222
Age, average (year)	6.4	7.4	8	9	10	8
Manufacturers represented (No.)	7	8	8	9	9	8
Types:						
Two-stroke-cycle (No.)	31	33	37	34	33	34
Four-stroke-cycle (No.)	26	38	38	39	40	36
Air-injection (No.)	25	34	37	38	40	35
Mechanical-injection (No.)	32	37	38	35	33	35
Semi-Diesel (No.)	16	16	16	16	14	16
Full-Diesel (No.)	41	55	59	57	59	54

Table II—Summary of Plant Load, Labor and Maintenance Data

Year	1933	1934	1935	1936	1937	5-Year Average
Plants reported	21	24	25	24	24	24
Units installed	57	71	75	73	73	70
Average values:						
Rated capacity per plant, b.hp.	1,675	1,965	2,370	2,388	2,527	2,185
kw.	1,148	1,348	1,640	1,663	1,756	1,511
Net output per plant, kw.-hr.	2,250,073	2,899,014	4,212,710	5,074,327	4,465,607	3,780,346
Auxiliary uses, per cent	4.9	5.6	5.9	5.7	6.3	5.7
Maximum hour, kw.-hr.	809	905	1,298	1,302	1,356	1,134
Annual load factor, per cent	36.9	38.0	35.8	41.2	40.0	38.4
Labor per plant, man-hours	12,710	13,622	14,283	15,902	17,457	*14,794
Cost material for engine maintenance, $	1,338	2,596	4,171	4,649	4,160	*3,382
Heat rate per net kw.-hr. output, B.t.u.	17,274	15,817	15,168	14,971	15,244	15,694

* Average for 22 plants.

*Abstract of paper entered for the Edison Electric Institute James H. McGraw prize for meritorious engineering papers.

engine maintenance was $3,382. In Table III this and other information is expressed in terms of brake-horsepower years. Materials and parts for maintenance are shown there to average $1.47 and maintenance labor (taken at the assumed low wage scale of 70 cents per hour) averages $1.01 per brake-horsepower year. Thus it appears that each brake-horsepower in plants having an average load factor of 38.4 per cent, with annual

Table V—Average Outage Factors

Year	1933	1934	1935	1936	1937	5-Year Total	Per Cent of Total
Number Diesel units reported	35	39	43	47	48	212	.....
Outage hours, total							
Engines	6,367	8,752	14,028	17,949	19,555	66,651	72.3
Generators	473	193	377	103	775	1,901	2.1
Auxiliaries	427	540	76	582	595	2,220	2.4
Other causes	34	9	42	73	237	395	0.4
Inspections (engines only)	2,397	5,804	4,272	3,518	5,052	21,043	22.8
Total	9,678	15,298	18,795	22,225	26,214	92,210	100.0
Outages, per cent of							
Period hours	3.1	4.5	5.0	5.4	6.4	24.4	5.0
Demand hours	7.7	10.1	10.4	10.1	13.3	51.6	10.5
Service hours	8.2	10.9	11.7	10.8	14.7	56.3	11.5

Table III—Analysis of Maintenance and Labor Expenses

Year	1933	1934	1935	1936	1937	5-Year Average
Material and Parts for Engine Maintenance						
Plants Reported (No.)	21	20	23	24	21	22
Material and parts, total	$28,074	$51,930	$95,924	$111,574	$87,356	$74,971
Average values:						
Materials and parts per plant	$1,338	$2,596	$4,171	$4,649	$4,160	$3,382
Materials and parts per engine	$493	$896	$1,450	$1,530	$1,386	$1,151
Materials and parts per b.hp.-yr.	$0.80	$1.25	$1.76	$1.95	$1.61	$1.47
Maintenance Labor						
Plants Reported (No.)	20	21	23	22	21	22
Maintenance labor, total (man-hours)	46,094	49,963	68,048	78,756	98,882	68,349
Average values:						
Maintenance labor per plant (man-hours)	2,305	2,380	2,959	3,580	4,709	3,187
Maintenance labor per engine (man-hours)	886	806	1,030	1,230	1,595	1,109
Maintenance labor per b.hp.-yr. (man-hours)	1.43	1.20	1.25	1.50	1.84	1.44
Maintenance labor cost at 70¢/hr. per b.hp.-hr.	$1.00	$0.84	$0.87	$1.05	$1.29	$1.01
Total Maintenance Cost						
*Approx. maintenance cost per b.hp.-yr.	$1.80	$2.09	$2.63	$3.00	$2.90	$2.48
Distribution of Plant Labor						
Plants Reported (No.)	13	15	16	17	16	15
Labor per plant, average:						
Operation (man-hours)	9,595	12,175	12,923	13,351	13,832	12,375
Maintenance, regular (man-hours)	1,727	1,457	2,940	3,521	4,025	2,734
Maintenance, extra (man-hours)	395	512	481	657	1,375	684
Total (man-hours)	11,717	14,144	16,344	17,529	19,232	15,793

*Exclusive of maintenance for building, electrical equipment, auxiliaries, and miscellaneous plant facilities.

Table IV—Summary of Operating Record for Diesel Units

Year	1933	1934	1935	1936	1937	5-Year Tota	Average per Unit	Per Cent of Period Hours
Diesel units reported, No.	35	39	43	47	48	212	1	.....
Rated capacity of units, b.hp.	21,395	25,560	39,100	42,640	46,285	174,900	825	.....
kw. H	14,816	17,656	27,586	29,946	32,486	122,490	577	.....
Kilowatt-hours generated G	29,017,066	36,285,309	84,246,720	108,293,405	88,379,470	346,221,970	1,633,122	.....
Period hours A	306,600	341,640	376,666	408,840	411,342	1,845,088	8,703	100.0
Demand hours B	126,200	151,111	179,788	219,162	197,200	873,461	4,120	47.3
Service hours C	118,116	141,384	160,877	205,182	178,413	803,972	3,792	43.5
Idle hours D	188,484	200,256	220,162	203,658	232,929	1,045,489	4,935	56.5
Reserve hours E	178,806	184,958	192,621	181,433	206,715	944,533	4,455	51.3
Outages, No.	653	825	1,061	1,547	1,223	5,311	25	.....
Outage hours, total F	9,678	15,298	(a) 18,795	22,225	26,214	(a) 92,210	(a) 435	(a) 5.0
Engines	6,367	8,752	14,028	17,949	19,555	66,651	315	3.6
Generators	453	193	377	103	775	1,901	9	0.1
Auxiliaries	427	540	76	582	595	2,220	10	0.1
Other causes (incl. inspections)	2,431	5,813	4,314	3,591	5,289	21,438	101	1.2
Operating factors, per cent:								5-Year Average
Service-demand B/A	41.2	44.3	47.8	53.6	48.0	.....	.....	47.3
Service-demand-availability C/B	93.6	93.6	89.5	93.7	90.5	.....	.....	92.1
Unit-capacity G/HA	22.4	23.5	35.3	41.6	31.8	.....	.....	30.9
Unit-output G/HC	58.1	56.8	81.7	82.9	73.2	.....	.....	70.5
Unit operation C/A	38.6	41.4	42.7	50.3	43.4	.....	.....	43.5
Max. possible unit-operation (C+E)/A	96.8	95.6	93.9	94.6	93.7	.....	.....	94.9

(a) Outage of 4,373 hours for rebuilding engine foundation at one plant, not included in outage hours.

capacity factor of 70.5 per cent, incurred a maintenance cost of $2.48 per year on the average on the Diesel engine alone. Total plant maintenance would involve repairs on auxiliaries, generators, switchboards, structures, cooling water systems which are not covered in this total.

Fifteen of the plants reported sufficient detailed data to indicate that 78.4 per cent of labor man-hours were appropriately chargeable to operation, 17.3 per cent to regular maintenance and 4.3 to "extra" labor obtained outside the plants. Inasmuch as this extra labor was not for operating purposes, it is permissible to state that maintenance labor in these instances represents approximately 21.6 per cent of total labor.

The index of availability of the Diesel units rests in an analysis of outages, outage-hours, idle hours, reserve hours, service hours and hours during which the units were in demand for service (*i.e.*, demand

[*Continued on page 127*]

Table VI—Analysis of Diesel-Plant Outage Hours

Year	Outage Hours					5-Year Total	Per Cent of Total	Number Machines Affected	Outage Hours per Machine Affected
	1933	1934	1935	1936	1937				
Number Diesel units reported	35	39	43	47	48	212	.....	.....	.....
Engines									
Main pistons and piston rings	1,228	1,206	1,748	3,099	4,281	11,562	13.2	139	83
Crankshaft	97	336	4,104	2,245	586	7,368	8.4	10	737
Air compressors (air-inj. engines)	735	452	1,069	1,111	1,609	4,976	5.7	67	74
Cylinder liners	55	1,796	879	272	708	3,710	4.2	28	128
Crank and piston-pin bearings	361	805	1,317	599	622	3,704	4.2	91	41
Exhaust valves (four-cycle eng.)	446	269	354	517	463	2,049	2.3	70	29
Main bearings (incl. thrust and outboard)	92	147	685	622	421	1,967	2.2	54	37
Fuel-spray valves (priming valves, etc.)	560	248	249	489	261	1,807	2.0	87	20
Cylinder heads	135	123	955	273	167	1,653	1.9	60	25
Governors and governor drives	1,083	142	72	172	71	1,540	1.8	41	38
Water cooling (incl. scale trouble)	116	236	496	241	358	1,447	1.7	66	22
Air-inlet valves	167	432	171	371	260	1,401	1.6	74	19
Fuel pumps, distributors, drives, etc.	189	196	240	445	203	1,273	1.4	90	14
Lubricating-oil system	102	183	272	209	464	1,230	1.4	71	17
Fuel-oil system	60	669	121	120	74	1,044	1.2	38	27
Cracked frames and cylinders	0	0	962	29	0	991	1.1	8	124
Crosshead pins and bearings	292	267	0	110	295	964	1.1	15	64
Scavenging pump (two-cycle eng.)	525	4	40	254	31	854	1.0	12	71
Piston cooling	57	146	59	337	100	699	0.8	33	21
Connecting-rod bolt failures	0	550	4	106	16	676	0.8	8	85
Exhaust ports, chambers, etc.	13	160	28	118	120	439	0.5	39	11
Cracked bedplate	0	0	0	0	406	406	0.5	1	406
Valve setting, timing, etc.	8	6	28	190	133	365	0.4	25	15
Starting trouble (incl. explosions)	8	161	17	52	0	238	0.2	19	13
Adjusting compression	17	0	8	35	24	84	0.1	13	6
Camshaft and bearings	0	11	0	0	41	52	0.1	7	7
Gears and chain drives	0	0	0	20	0	20	0.1	1	20
Vertical shaft and bearings	0	0	0	0	0	0	0.0	0	0
Vibration	0	0	0	0	0	0	0.0	0	0
General overhaul	0	0	0	4,390	6,521	10,911	12.4	15	728
Miscellaneous	21	207	150	1,523	1,320	3,221	3.7	39	83
Subtotal (engine outages)	6,367	8,752	14,028	17,949	19,555	66,651	76.0	.....	.....
Inspection and adjustment	2,397	5,804	4,272	3,518	5,052	21,043	24.0	127	166
Total	8,764	14,556	18,300	21,467	24,607	87,694	100.0	.....	.....
Generators									
Armature windings	38	37	105	7	521	708	37.3	14	51
Field windings	381	43	7	0	8	439	23.1	9	49
Exciter	14	72	43	44	91	264	13.9	26	10
Vibration	0	0	144	0	0	144	7.6	8	18
Alignment	3	0	9	0	67	79	4.2	3	27
Collector rings	0	0	0	0	76	76	4.0	2	38
Painting	0	0	34	1	6	41	2.2	3	14
Bearings	0	0	10	0	0	10	0.5	1	10
Armature core	10	0	0	0	0	10	0.5	1	10
Lubrication	0	1	0	0	0	1	0.0	1	1
Miscellaneous	3	40	25	3	0	71	3.7	13	5
Inspection and adjustment	4	0	0	48	6	58	3.0	6	10
Total	453	193	377	103	775	1,901	100.0	.....	.....
Auxiliary equipment									
Water-cooling system	218	7	13	394	0	632	28.4	12	53
Exhaust system	57	254	32	0	55	398	18.0	8	50
Lubricating equipment	43	136	0	35	3	217	9.8	12	18
Air compressors	0	94	10	1	81	186	8.4	8	23
Fuel-oil equipment	21	27	0	1	0	49	2.2	8	6
Air-intake system	0	4	20	4	15	43	1.9	4	11
Water pumps	0	18	0	23	0	41	1.9	3	14
Air receivers	1	0	1	6	0	8	0.4	4	2
Air piping	0	0	0	0	5	5	0.2	1	5
Automatic-control equipment	0	0	0	0	0	0	0.0	0	0
Miscellaneous	87	0	0	10	0	97	4.3	3	32
Inspection and adjustment	0	0	0	108	436	544	24.5	4	136
Total	427	540	76	582	595	2,220	100.0	.....	.....
Other causes									
Storms	0	0	0	0	180	180	45.6	4	45
Plant electrical	15	1	19	49	42	126	31.9	21	6
Piping	17	0	23	7	15	62	15.7	9	7
Lightning damage to generator	0	0	0	13	0	13	3.3	1	13
Outside electrical	0	6	0	0	0	6	1.5	1	6
Miscellaneous	2	2	0	4	0	8	2.0	4	2
Total	34	9	42	73	237	395	100.0	.....	.....

Rack Co-ordinates Relay Selectivity

Strip current scales placed against contact-closing-cycles scale avert endless redrawing of relay curves for selectivity and co-ordination studies

CHARLES L. BETTS, Jr., Relay Engineer Westchester Lighting Company*

RELAY CURVES supplied by relay manufacturers are usually replotted by relay engineers for greater convenience in co-ordinating protective schemes for selectivity. They are plotted to larger scale, transformed to logarithmic co-ordinates and the ordinate scale changed from seconds to cycles to close contacts. To make such replots most convenient in connection with studies of fault currents in feeders and transformer banks it is necessary to multiply by current transformer ratio and again by number of times pick-up current obtained. A new rack method employing a single cycles-to-close scale and as many strips of fault current scales as there are relays involved in the faulted interconnection effects a large saving in time and labor.

A set of typical time-current curves for an overcurrent relay is shown in Fig. 1. Typical current distribution for a three-phase fault on a 13-kv. bus is shown in Fig. 2.

Relay Rack

Fig. 3 shows the determination of requisite relay selectivity for a substation; each relay curve is plotted on the basis of 13-kv. fault currents. How the lower curve is converted to a typical relay current scale is shown in Fig. 4. And, finally, this scale is associated with similar scales for relays in other feeders and buses as in Fig. 5 to determine selectivity sequences.

The rack method for determining selectivity obviates the redrawing of relay time-current curves. All relay curves are plotted to the same scales of co-ordinates—currents and cycles to close contacts. The current values are projected to a ½-in. strip of paper which has a zero coincident with the zero of the cycles scale. Each strip is identified at the top by the feeder or transformer number, the type of protection (overcurrent or directional), the relay setting (in values of primary current cycles), the type make and rating of relay and the current transformer ratio.

The cycles scale and the current scales for several different feeders are used in the following manner. A rack or board is constructed with a cycles scale on the left-hand edge, and to the right slots or spaces are provided for inserting several current scales. The bottom edge of each current scale must be on the same horizontal line as the zero of the cycles scale. The current scale for the relay on the faulted feeder is placed in the first current scale space to the right of the cycles scale, the other spaces to the right being filled with current scales for all the other relays with which the faulted relay must select.

The current scale spaces are provided with indices or movable markers to indicate the primary current flowing over the faulted feeder and also over the associated feeders. A straight edge is provided for visually

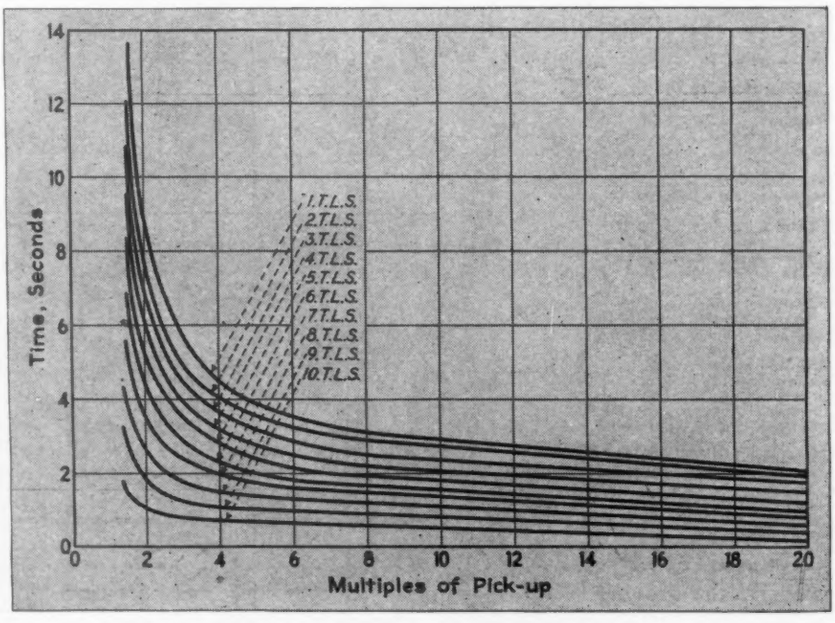


FIG. 1—FAMILIAR time-current curves for an IAC overcurrent relay

*Abstract of E.E.I. paper awarded second of three James H. McGraw prizes for "meritorious papers on any engineering or technical subject relating to the electric light and power industry."

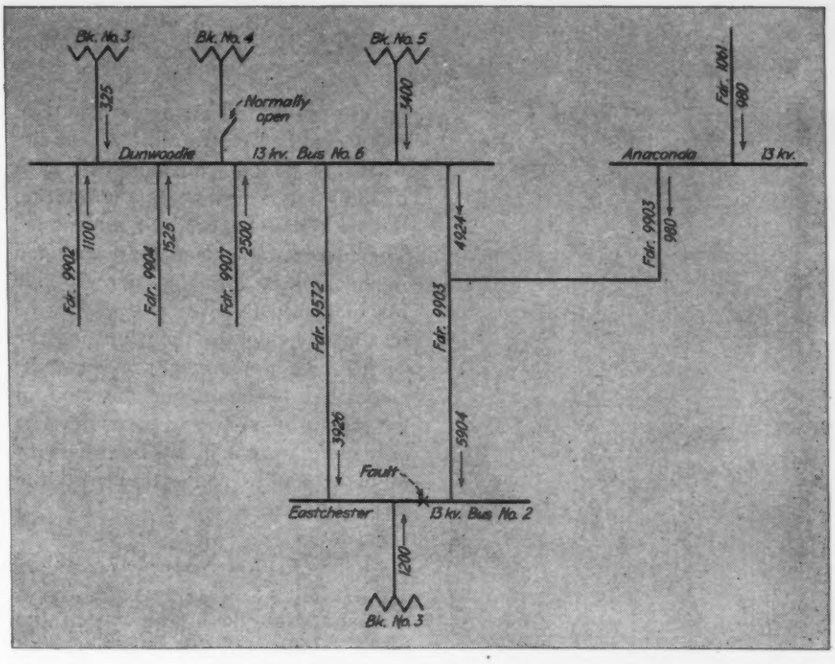


FIG. 2—CURRENT DISTRIBUTION for a 13-kv. bus fault at Eastchester substation Determined from a d.c. calculating board study. Relay curves for selectivity of the directional relays on Fdr. 9572 at Eastchester with respect to those on 4-kv. side of bank No. 3, to overcurrent relays at Dunwoodie on 9903 and to directional relays at Anaconda on 9903 are shown in Fig. 3.

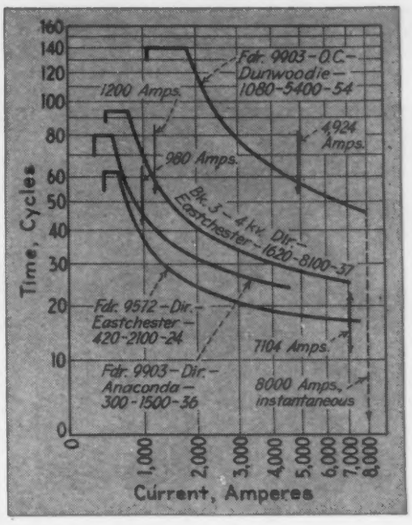

Time, Cycles
Current, Amperes
Fdr. 9903 - O.C. - Dunwoodie - 1080-5400-54
1200 Amps.
4,924 Amps.
980 Amps.
Bk. 3 - 4 kv. Dir. - Eastchester - 1620-8100-37
Fdr. 9572 - Dir. - Eastchester - 420-2100-24
7104 Amps.
Fdr. 9903 - Dir. - Anaconda - 300-1500-36
8000 Amps., instantaneous

FIG. 3—REPLOTTED relay curves for selectivity for fault on Feeder 9572 at Eastchester. Each marked with the pickup current, the trip current and cycles to close contacts. Curves plotted on a 13-kv. base

projecting these markers to the left, or to the cycles scale, in order to determine the tripping time of each relay for the particular current value to which each marker is set.

A horizontal slot or space is provided at the base of the rack, below the zero line of the cycles scale and below the bottom of the current scales slots. This space is 1¼ in. in width (the length depending on the length of the rack) and is furnished for the "selectivity scale." The selectivity scale is made up of a strip of paper 1¼ in. in width which is ruled vertically to correspond to the current scales placed above it. The left hand column will be placed under the first current scale, or, in other words, under the current scale for the faulted feeder. The other columns to the right are placed to correspond with the other current scales in the rack.

In these columns on the selectivity scale is placed the feeder designation and type of protection according to the arrangement of the current scales in the rack above, together with the current flowing over each feeder under consideration, and the tripping time as determined by projecting across to the cycles scale by means of the straight edge. Thus the selectivity scale or table is nothing more than a tabulation of the results.

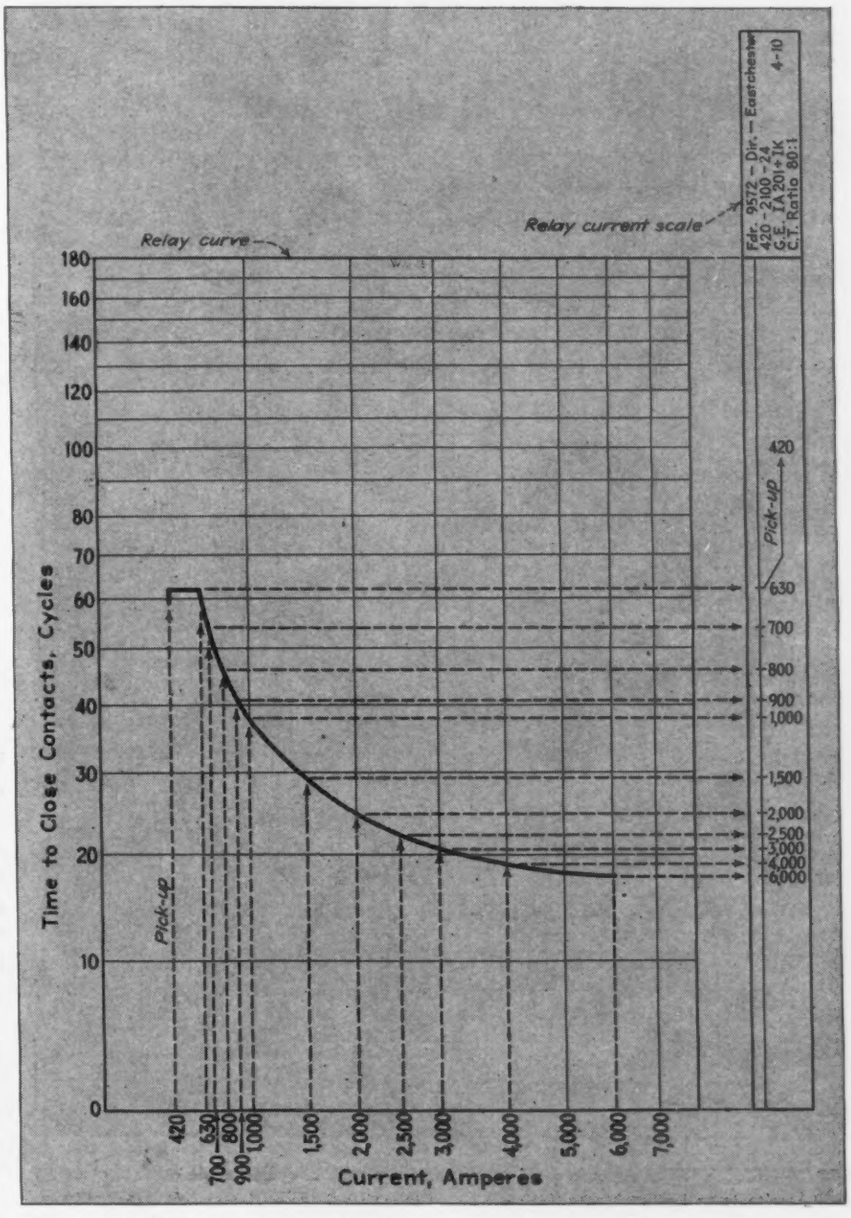


FIG. 4—METHOD of constructing typical relay current scale—the curve is the same as the lower one in Fig. 3

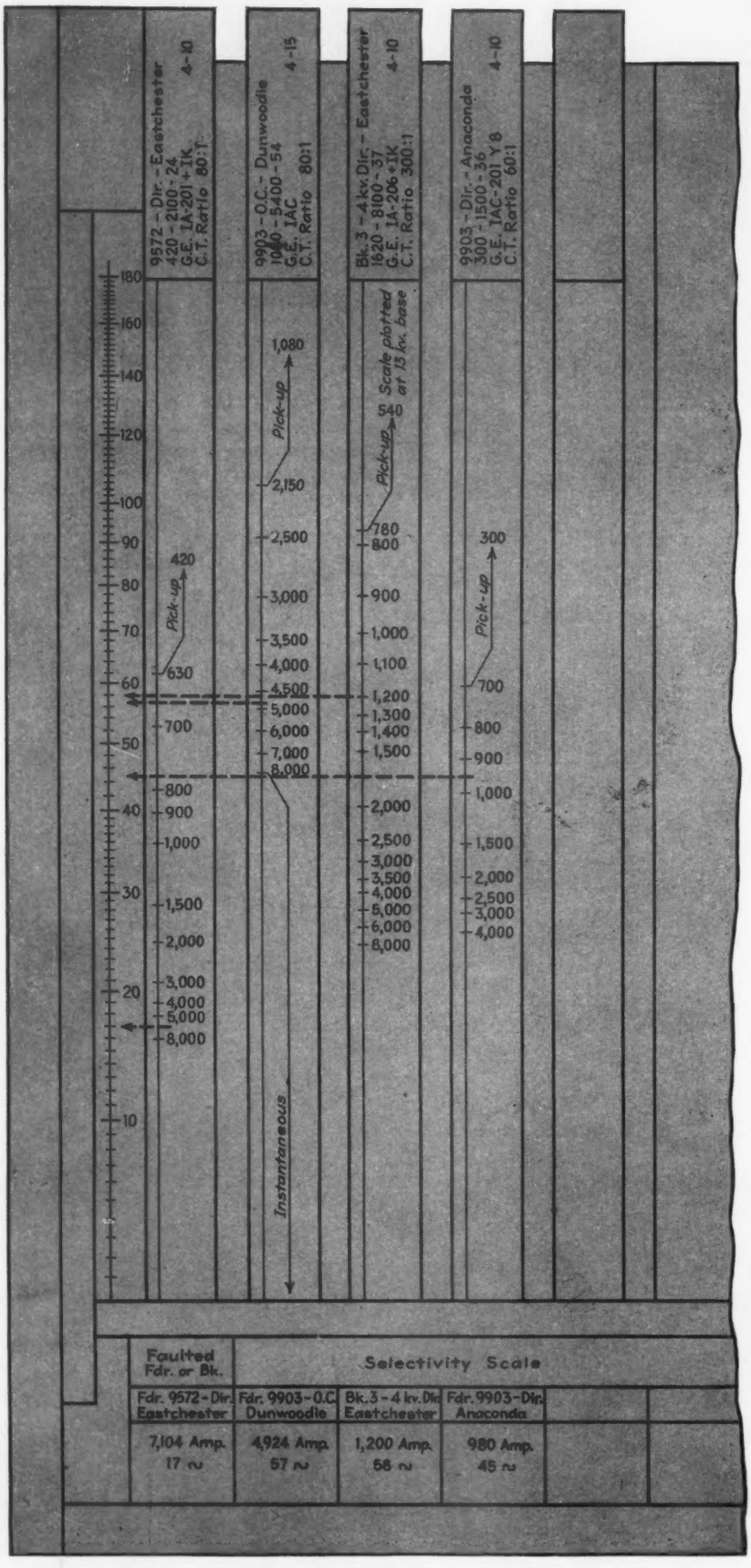


FIG. 5—RELAY RACK embraces all relay current strips, a cycles scale and a selectivity scale

Instead of redrawing a group of relay curves to determine selectivity when the fault is considered on each of the various feeders at a substation the rack can be used to advantage. The current scales can be rearranged in the rack so that the current scale for the faulted feeder will always be in the first slot to the right of the cycles scale, the current scales for the associated feeders being inserted in the remaining spaces to the right. The only changes that it will be necessary to make are in connection with the selectivity scales.

Typical Example

As an example in the use of the rack, a fault will be considered on Fdr. 9572 at Eastchester near the 13-kv. bus No. 2. The current scale for the directional relay on Fdr. 9572 at Eastchester will be placed in the first current scale space to the right of the cycles scale. The current scales for the other relays with which Fdr. 9572 directional relay at Eastchester must select will be placed in the additional spaces to the right. As each of the current scales is placed in the rack, the markers will be set or adjusted to the proper amount of current as shown in Fig. 5. Then these current scales will be placed in the rack in the following order from left to right and with the markers set to the following values of current on each:

1. Fdr. 9572 directional at Eastchester, 7,104 amp.
2. Fdr. 9903 overcurrent at Dunwoodie, 4,924 amp.
3. Bank No. 3, 4 kv. directional at Eastchester, 1,200 amp. (at 13 kv.)
4. Fdr. 9903 directional at Anaconda, 980 amp.

By means of the straight edge it will be possible to project these values of current over to the cycles scale, the results of this projection being inserted on the selectivity scale, which will be arranged to correspond to the current scales above. Accordingly the selectivity scale will give the following information in the columns:

1. Fdr. 9572 directional at Eastchester, 7,104 amp. in 17 cycles.
2. Fdr. 9903 overcurrent at Dunwoodie, 4,924 amp. in 57 cycles.
3. Bank No. 3, 4-kv. directional at Eastchester, 1,200 amp. in 58 cycles.
4. Fdr. 9903 directional at Anaconda, 980 amp. in 45 cycles.

Thus it can readily be seen that for a fault on Fdr. 9572 at Eastchester

[*Continued on page 116*]

Base Safety Lighting on Accurate Accident Data

Southern California Edison procedure embraces simplified summaries of traffic accidents as reported by deputy sheriffs, road departments and traffic engineers

A. L. PRYOR, Southern California Edison Company, Los Angeles, Calif.*

ACCURATE statistical information is the heart of any accident prevention program, and Los Angeles, Calif., County has developed a system of recording traffic accidents that is unique in its simplicity and effectiveness as a source of information upon which to base preventive action.

It would be fine indeed if some one would invent a device which would single out the places where accidents are going to happen. Unfortunately, it is impossible to predict exactly where or when accidents occur. Even the experienced traffic engineer has no more than an opinion without reference to complete accident records.

Most traffic and road departments have access to some type of accident records. Many are inadequate, however, while others are so complicated that their files become more graveyards of information. Proper use and exchange of this life-saving information involves much time and expense.

4,500 Miles of Roads

The new Los Angeles County traffic accident recording system is simple, economical and complete, providing a scientific basis for the provision of safety measures at points found dangerous. Although the system has been in use only a short time, it indicates that adequate street lighting is a solution to many night accident problems, and it is anticipated that use of this system over an extended period of time will prove this point conclusively.

*Street lighting engineer.

Los Angeles County, with an area of 4,000 square miles, a population of some 3,000,000 people and 4,500 miles of roads, streets and highways, exclusive of the streets in 44 incorporated cities, presents a difficult accident recording problem. The study to provide its solution was directed by Road Commissioner George W. Jones and was accomplished by Traffic Engineer Melvin J. Bankhead, who had been engaged in research to simplify accident records and expedite their use.

Another county official, Sheriff E. W. Biscailuz, realized the necessity for more complete information on traffic accidents involving property damage, injury or death. He inaugurated a special training school in accident investigation and reports for deputies, which has resulted in his files presenting information which is both adequate and accurate.

Not only is this type of information necessary to an effective accident recording system, but provision is necessary for quick reference to it. The immediate visual indication provided by the "spot" type of map was incorporated in Los Angeles County's system. Forty 60 x 84-in. sliding veneer panels, with a map on each side of each panel, form its nucleus. The usual procedure of using colored pins or ink spots for showing location or type of accidents was replaced by small hooks screwed into the boards at locations corresponding with accident reports. A small metal-rimmed paper tag is hung on each hook for each accident. The number on the front of the tag and its color represent the number of accidents at a location, while the number on the back corresponds to the number of the accident report. A glance at the map therefore reveals frequency of accident occurrence at any location.

Nearby are the filing cabinets containing accident reports from the sheriff's office, filed according to existing case or serial number. A few special report and tabulating forms were the only other special equipment required in this system, the simplicity of which saves time and money, and its completeness makes solutions easy. [*Continued on page 115*]

ACCIDENT No. 2 chalked up—Traffic Engineer M. J Bankhead of Los Angeles County refers to aut accident tag spotted at exact location on traffic acci dent recording system. Eighty such map panels ar used to organize accident data supplied throug co-operating sources

More Power for the Power Salesman

Continuous, planned, organized advertising campaigns which are aimed at specific targets are employed by Pennsylvania utilities to support power sales drives

H. S. METCALFE,* West Penn Power Company, Pittsburgh, Pa.

AT THE AGE of 27 he arrived in New York with a wife, a sick child and no job. For two weeks he pounded the pavements going from one newspaper office to another. Seldom did he even get to see the editors. They just sent out word—"Sorry, no help needed." In desperation he sat down and wrote every editor a letter which ended as follows:

> This is positively your last chance. I have grown weary of studying the wallpaper design in your anteroom. A modest appreciation of my own worth forbids me doing business with your head office boy any longer. Unless you grab me right away, I will go elsewhere and leave your paper flat on its back right here in the middle of a hard summer, and your whole life hereafter will be one vast surging regret. The line forms on the right; applications considered in the order received; triflers and professional flirts save stamps. Write, wire or call.
>
> IRVING S. COBB.

The next day Cobb had offers of four jobs. Advertising had in one day covered the same territory it had taken Cobb two weeks of painful plodding to cover. What is more, it had broken down barriers which he personally had been unable to hurdle.

We must remember that before he actually closed the deal Cobb had to present himself and do a job of personal selling. All that the letters really did was to narrow the field of prospective employers from perhaps 50 down to four. Essentially that is the same problem which power salesmen face every day.

Likewise, advertising is an aid to industrial power sales because it

1. Narrows the field down to live prospects.
2. Helps arouse interest in new ideas.
3. Supports the power salesman's claims with proof.
4. Personalizes company with frequent contacts.
5. Sells small jobs which do not justify personal selling.

The use of regular and special direct mail media by utilities is both justified and sound, for it

1. Indirectly helps create acceptance for new ideas.
2. Directly produces definite inquiries for power men to work on.
3. The majority of sales executives who know the value of advertising by experience are enthusiastic with its results.

The field of advertising can be extended for individual companies by

1. Use of already available and acceptable forms of media.
2. Exploring the field for new forms and, where possible, using them.

Narrows Field

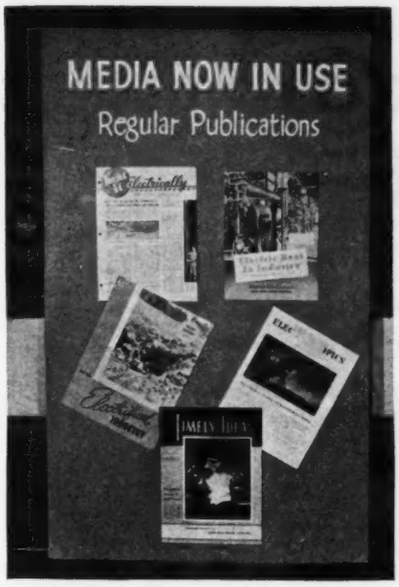
On the average, according to a survey of Pennsylvania Electric Association members, each power salesman is responsible for about 200 industrial customers. Every one of these customers is a prospect for some additional load and many of them are prospects for scores of new applications. That is, a single plant may be a prospect for three different types of lighting, four kinds of electric heat, five new motor applications, a conveyor system, an air compressor and several minor uses. Counting every potential load in your prospect file, the total may run into the thousands. If you did nothing but make one contact for each prospective load it would probably take you more than a year to get around once. But, of course, you don't work that way. Many of your prospective loads are too visionary to waste time on. As one power man once told me: "If some of the customers knew the things I have them 'down for' on my prospect list, they'd have me sent to a state institution on the ground that I was suffering from delusions of grandeur."

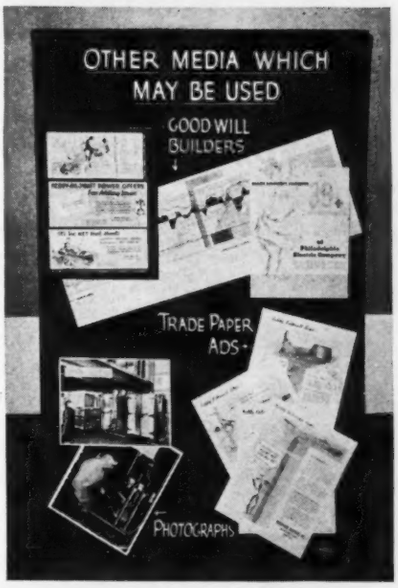
Actually, many of these visionary applications might prove highly practical if tried, but the customer considers them too radical. I know of one case where a customer turned down a power man's suggestion for using inductive heat in his process because he had never heard of it before. Several years later he was paying royalties to use inductive heating because some one else had seen the possibility and developed it. If the power man had stuck with this prospect he might have sold him on the idea in the first place, but the power man couldn't afford the time it would have required.

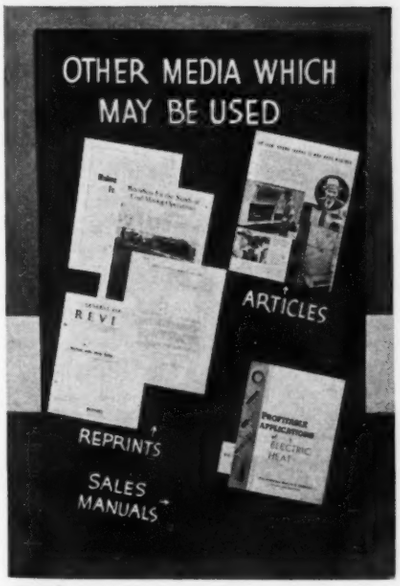
As good managers of your time you do just what Irving S. Cobb finally did. *You narrow the field from the thousands of suspects down to a handful of good live prospects.* These are the fellows who send you an inquiry, ask leading questions, or show immediate interest when you mention the application you have in mind.

Now, live prospects don't just grow like Topsy. Something or somebody has to start the prospect to thinking. Something or somebody has to move along the prospect on the road to a sale by *introducing* the idea, gaining *attention* and *stimulating interest.*

*Director of public relations.







AMMUNITION used by Pennsylvania utilities to create interest of power customers and aid power sales

Actually, there are a number of influences constantly at work on your customer's mind inducing him to make changes and improvements in his methods. Always in the background is a desire to make greater profit, to make a better product, to meet competition on both price and quality. He picks up ideas on how to do these things from many sources. Here are a few of the most common sources of influence:

(a) Word of mouth stories from other industrial men.
(b) Trade paper articles.
(c) Trade association meetings, conventions, engineering society conferences.
(d) Equipment manufacturers' advertising and salesmen.
(e) Utility companies' advertising and salesmen.

Sometimes two or three, or even all five, of these sources work together to focus attention on one particular better way of doing things. It is seldom that a customer gives serious consideration to an expensive piece of new equipment on the basis of one article in a trade paper or one advertisement. There are exceptions, though. Recall what happened following the appearance of the first ads on fluorescent lighting. Customers from Maine to California were clamoring for "that new kind of light that cuts light bills in half." Ordinarily, though, interest in a new method is the sum of a number of very subtle impressions, bits of conversation, trade paper articles, speeches and advertising.

Supporting Proof

Naturally, the more impressions we make on our customers the sooner they arrive at the point of interest. Yet four of the sources we have listed as influencing the customer's mind are beyond our direct control. As a consequence, these four influences are sometimes feeble and oftentimes unfavorable.

That leaves us but one source that can be bent to our own will—your personal influence and the influence of your company's advertising. Properly used, advertising can introduce many ideas and by repeated impressions influence the customer to show interest in new uses for power. Then the industrial power man steps in and turns the prospect's *interest* into *desire*, makes the *drive for close* and sells the job.

In most cases advertising may not single-handedly take the prospect beyond the point of interest, but it can work with the power man to advance the customer further along the road to a sale by backing up the power man's claims with proof. We are familiar with the newspaper headline which reads: "Girl produces letters, gets $50,000 heart balm." Such headlines prove the truth of that oft-repeated warning: "Don't put it in writing unless it is true." People are more inclined to believe a story when they see it in print. The same principle applies to your customers about a new electrical application. When that story is backed up with photographs and performance data it supports what the power man has said verbally and gains further acceptance.

Frequent Contacts

Another way in which advertising can help the power man is to dramatize and give personality to a service which otherwise might be remembered only by the size of the monthly bill. If a little more of this type of promotion were done it would eliminate many of the complaints and cases of jeopardy.

Now if a power man was able to see his customers once a week, he would have no trouble getting those customers acquainted with his company and its policies, but with 150 to 200 customers to call on, this is out of the question. Some customers only see him once or twice a year. When you figure that on a pro rata basis every call made on a customer costs your company $10 to $20, it is easy to see why a $500-a-year customer couldn't justify many calls.

That's where advertising can do the job and act as the power man's stand-in.

Sells Small Jobs

Advertising can sell applications which are too small for the power man to bother with. For instance, when a group of power men were questioned about why no electric glue pots appeared on their lists of prospects for electric heat, they replied: "Why, all our wood-working plants are using electric glue pots." These loads of one or two kilowatts had never been reported, but had been silently promoted and sold by repeated stories in publications.

[*Continued on page 116*]

Low-Cost Bird-Proof Gaps Protect Rural Transformers Effectively

Oklahoma utility adopts bird-proof multiple gap for lightning protection of rural transformers — Finds gap an economical solution to lightning protection of rural transformers

C. E. BATHE, Oklahoma Gas & Electric Company, Oklahoma City*

USE of inexpensive gaps for lightning protection of rural line transformers is one of the many efforts that have been made to reduce the cost of electric distribution facilities within the past few years.

Like many of the other changes, the economics of the use of gaps for rural transformer lightning protection cannot be fully determined except by operating experience. Recently accumulated data have more accurately established some of the pertinent factors.

Two questions inevitably arise in any study of the economics of providing rural transformer lightning protection with gaps:

1. What will be the lightning failure rate of transformers protected with gaps?

2. By how much will the lightning tripout rate of lines using gap-protected transformers be increased over similar lines using lightning arrester-protected transformers?

Failures Seldom

In answer to the first question, operating records of the Oklahoma Gas & Electric Company reveal that in a group of 530 7,200/120-240-volt, single-bushing, rural transformers equipped with varied types of lightning protective gaps one transformer failure from lightning has occurred over a period of eighteen months. This transformer was equipped with an open type double gap, the total gap length of which was found to be 3½ in. This setting was 1 in. greater than the prescribed setting of 2½ in. which was the standard for single gaps and for the combined length of the two gaps in double-gap assemblies. These and other data contained in this discussion include only equipment used on 7.2-kv./12.5-kv. wye, three-phase, or 7.2-kv., single-phase, multi-grounded, common neutral circuits.

BIRD-PROOF double gap, with one gap inclosed, offers effective lightning protection of rural transformers at reasonable cost. Typical installation on 7,200-volt transformer of Oklahoma system

To answer the second question, tripout records have been kept on a number of line sections of various lengths, some line sections having the transformers equipped with gaps and some having the transformers equipped with lightning arresters. The average density of the transformers equipped with gaps is approximately two transformers per mile. The lightning tripout frequency rate for lines with gap-protected transformers has been 1.4 tripouts per mile per year and the lightning tripout rate for the lines with lightning-arrester-protected transformers has been 0.51 tripout per mile per year. Other transformer densities would presumably modify this ratio.

In the earlier installations of transformers with bushing gaps, some had single gaps and others had double gaps. In the late spring and early

*Electrical engineer transmission and distribution department.

summer of 1938 a large number of line tripouts were caused by birds short circuiting the gaps. In fact, the trouble became so severe *on the single-gap installations* that these gaps were hurriedly removed, leaving the transformers unprotected for a few months until an improved protective scheme could be developed. Some operations of the open type *double gaps* were caused by birds, although the number of such cases did not necessitate removal.

Inclosed Gap

Lightning protection by the use of gaps had been satisfactory enough to direct our efforts toward the development of a low-cost bird-proof gap. A double gap having one of the gaps inclosed seemed to offer a probable solution. An electric equipment manufacturer had previously supplied some equipment having an element similar in construction to the inclosed gap unit desired and his cooperation in the development of the new gap was secured. It consists of a gap formed inside of a fibre-bakelite tube by means of two $\frac{3}{16}$-in. copper electrodes. The tube is mounted in a vertical position on top of the transformer tank by a metal bracket, which is made locally. An adjustable electrode at the top of the tube provides the external gap which is formed between this electrode and the bushing gap. The accompanying illustration shows a typical installation.

Transformers Equipped

Three hundred and fifty 7,200-volt transformers on the Oklahoma Gas & Electric system were equipped with these gaps during the latter part of 1938. Experience since then has shown them to be a satisfactory bird-proof device. One weakness has, however, been observed. The copper internal electrodes in a portion of the gaps that have been inspected show some burning, with consequent elongation of the internal gap, in one case the gap length having been increased by $\frac{1}{2}$ in. Necessarily long blowing time of line-sectionalizing fuses in some applications probably accentuates this weakness. Ground fault currents in the range of 30 to 40 amp., with attendant sectionalizing fuse blowing times of one to $2\frac{1}{2}$ seconds, are not infrequent on some of the longer rural lines.

The manufacturer's consideration of the electrode-burning problem, with its probable effect on the protection afforded the transformer, was solicited in the latter part of 1939. Within a short time a new design was submitted which promises improved performance. One hundred gaps of this new design were procured in March, 1940, most of which have now been placed in service.

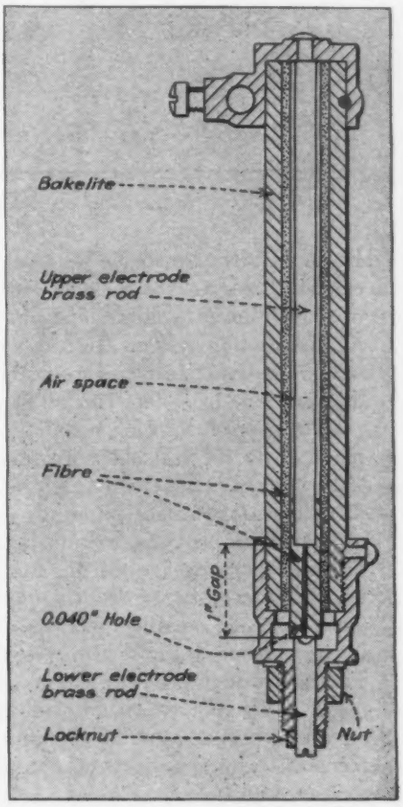
This latest design incorporates $\frac{1}{4}$-in. brass electrodes instead of the original $\frac{3}{16}$-in. copper electrodes. A fibre insert between the electrodes has been added to provide an arc-extinguishing characteristic. The unit may be disassembled to permit inspection and repair. A 1-in. internal gap is provided and an external gap of 1 in. is being used. A cross-sectional view of the latest design is shown.

Getting the Answer

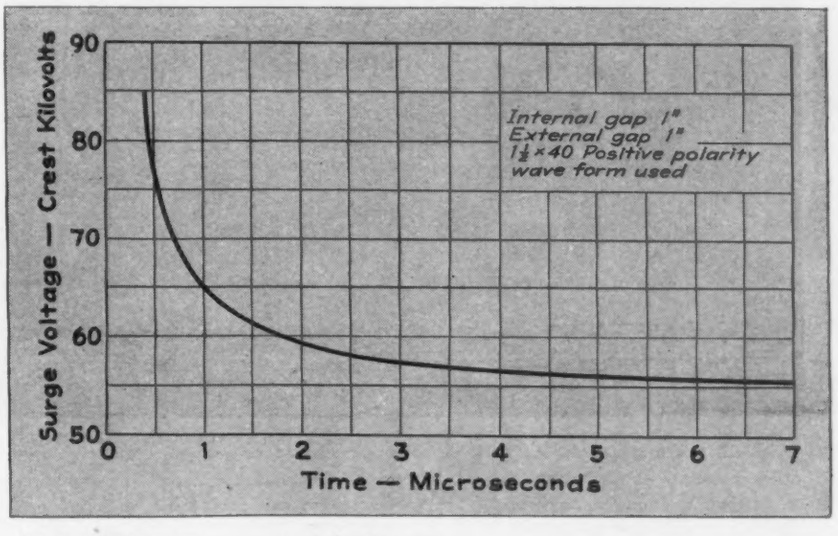
Although further experience will be required properly to judge the merit of the latest refinements of this inclosed gap, it appears that the problem of arriving at a low-cost lightning protection scheme for rural line transformers is approaching a satisfactory solution.

Data submitted by the manufacturer show that on laboratory test using an available follow current of 32 amp. at 6,900 volts, and with a 1.5 x 40 positive surge of sufficient magnitude to spark the gap released at the negative peak of the 60-cycle voltage wave, fifteen shots did not produce any burning of the electrodes and did not increase the bore of the fibre insert. With a follow current of 1,450 amp. successful operation was secured for five shots, with failure occurring on the sixth. The manufacturer anticipates extended successful performance on follow currents up to 600 amp. at 7,200 volts.

The manufacturer's voltage-time breakdown curve of the gap assembly using an internal gap of 1 in. and an external gap of 1 in. for 1.5 x 40 positive surges is reproduced.



CROSS-SECTION of double bird-proof lightning protective gap. Note 1-in. internal gap with fibre insert to provide arc-extinguishing characteristic



VOLT-TIME breakdown curve of double gap

Distribution Outlays to Limit Lamp Flicker—II

Variable-voltage control and wye-delta switching for elevators — Cases of expensive welder flicker correction are cited — Criteria for economical alternatives for line and substation

D. K. BLAKE, General Electric Company, Schenectady, N. Y.*

ELEVATORS, resistance welders and electric furnaces are cited as sources of lamp-flicker voltage disturbance on distribution systems. In fact, some of the most expensive increments to distribution to offset flicker complaints arises from such installations, particularly the resistance welders.

Fortunately, the trend in elevators in modern large office buildings is to use the variable-voltage-control type having a separate motor-generator set for each elevator. Starting the motor-generator set is easily taken care of by increment starters if necessary. The elevator accelerating peak demand is nearly twice the full-load running current, but due to requirements of riding comfort the acceleration must be smooth, and as a rule the peak is reached about 1½ seconds after the car begins to move, consequently the acceleration of one car alone will not cause objectionable flicker. In buildings with a large number of elevators several of the cars may be accelerated simultaneously, and in such cases the inrush peak may reach high values, but even in these instances the maximum is reached gradually and the likelihood of a sufficient number of cars starting at exactly the same instant is extremely remote.

Y-Delta Switching

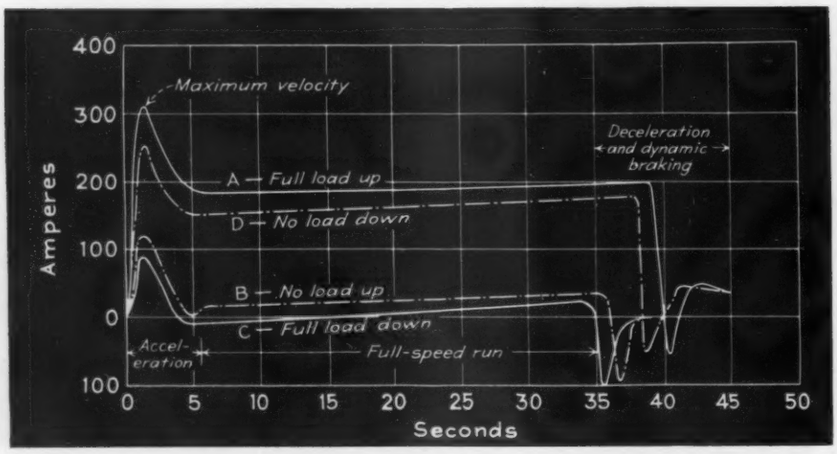
Y-delta switching of the a.c. motors of the motor-generator sets has been practical for reducing the losses while the cars were idle. The windings of the a.c. motor were connected from delta to Y during idling and switched back to Y before the instant of starting. This type of switching has caused annoying flicker, because at the instant of switching from Y to delta there was a momentary inrush of several times the full-load current. The frequency of the flicker was substantially reduced and its annoying characteristic largely eliminated by using the Y-delta transfer only at the terminal landings and not using the transfer at intermediate stops. The transients, at the instant of throwover to delta, have also been reduced by connecting the windings to the lines through grid resistors and short circuiting these shortly afterward.

Slow-Speed Elevator

Many cities now have low apartment houses and office buildings that are equipped with slow-speed elevators operated by three-phase motors from 10 to 20 hp. and higher apartment houses and offices using two speed a.c. motors up to 40 hp. In overhead distribution areas it is a relatively simple matter to locate a transformer near the building and avoid long, heavy secondary conductors. While some expense is involved in the relocation or replacing of transformers in such areas, it is small in comparison with underground areas with either radial or network system of distribution.

In an underground system a transformer location at the building means a new subway vault or a vault in the apartment building. The costs of reinforcing the underground secondary conductors in three cases were $260,

*Engineer of distribution systems, central station department. An article in the September 21, 1940, "Electrical World" discussed the matter of appliance motors and others of larger size on radial distribution.



TYPICAL operating cycles of variable-voltage-controlled high-speed elevators in large office buildings—Rated carload 2,500 lb., rated car speed 750 f.p.m. The gradual rise in current, reaching a peak about 1½ seconds after the car begins to move, greatly reduces lamp flicker annoyance

$1,240 and $2,200, respectively. One case involving an additional bank of transformers as well as secondary conductors cost approximately $4,800. At such figures it takes only a small percentage of apartment buildings to make significant the average cost to eliminate flicker. For example, if the total of $8,500 corrected 10 per cent of the total apartment buildings, the average cost per building is about $210. If each apartment building has 50 consumers, the cost per consumer is about $4.

Resistance Welders

Resistance welders have in recent years become very common in a great variety of ratings and are in some instances large enough to have widespread voltage dip effects over a whole substation area. Welders are applied in areas supplied by underground low-voltage a.c. networks as well as by overhead systems. When welders are applied on underground networks the expense involved in system reinforcement may be startling, as the following examples show:

Case I—A 60-kva., 220-volt resistance welder produced inrush currents up to 700 amp. and a dip of 7½ volts. After $5000 was expended on secondary mains reinforcements the flicker was still objecttionable. In connection with general load increase, the system was further reinforced in the vicinity, including several 500-kva. banks of transformers. In spite of this a new complaint was received from a nearby consumer. A new transformer and manhole near the welder service added $15,000 to the expenses.

Case II—A 128-kva., 220-volt resistance welder operates at an intermediary tap, drawing 265 amp. and incurring a 3-volt dip. On the highest tap it would draw 425 amp. Should a complaint be received due to the increase of the welding load it would be necessary to build a new transformer manhole and install a special set of mains cables and service cables to supply the welder directly from the vicinity of the transformer manhole; $15,000 would be the approximate cost of this system reinforcement.

Case III—A 225-kva., 220-volt spot welder caused dips of 12 to 14 volts on the lighting service in the immediate vicinity of the plant. To rectify the conditions causing complaints of flicker the two 300-kva. banks were replaced with two 500-kva. banks and additional secondary ties were made to the adjacent network at a cost of between $30,000 and $40,000. Despite this reinforcement dips of from 1 to 6 volts occurred at various locations supplied by the same secondary network system. Later, additional complaints were received from residents in the vicinity and voltage fluctuations from 2 to 10 volts were measured. To overcome the fluctuations on nearby lighting services separate underground cables were installed to feed the other services from as far away from the welder service as possible. The cost was in the neighborhood of $6,000.

In overhead areas resistance welders are generally confined to the secondary of individual transformers serving one establishment. In such cases the lighting disturbance caused by transformer drop disturbs only that consumer, and if unsatisfactory to him can be corrected by him with some change in the welding equipment, the use of a motor-generator set, series capacitor or a separate single-phase transformer. The latter, of course, complicates the metering. If, however, the load is large enough the inrush current flowing through primary circuits produces a voltage dip that may be enough to require primary-circuit reinforcement. Table I gives an idea of the distances various welding loads would cause a 3 per cent voltage dip in the primary feeder alone, assuming the substation transformer drop is negligible. Obviously, welder loads and distances are so related as to give serious concern to the engineers who are responsible for distribution system design.

Table I—Allowable Length of Line for 3 Per Cent Drop, Single-Phase Welders

(59-In. Spacing and 0.35 P.F.)

Volts	Conductor Size	Miles				
		100-Kva. Inrush	200-Kva. Inrush	300-Kva. Inrush	500-Kva. Inrush	1,000-Kva. Inrush
2,400	No. 6	0.567	0.283	0.189	0.113	0.0567
	No. 4	0.706	0.353	0.235	0.141	0.0706
	No. 2	0.848	0.424	0.283	0.169	0.0848
	No. 1/0	0.982	0.491	0.327	0.196	0.982
	No. 4/0	1.16	0.580	0.386	0.232	0.116
4,160	No. 6	1.7	0.85	0.566	0.34	0.17
	No. 4	2.12	1.06	0.707	0.424	0.212
	No. 2	2.54	1.27	0.847	0.508	0.254
	No. 1/0	2.94	1.47	0.980	0.598	0.294
	No. 4/0	3.47	1.73	1.16	0.694	0.347
4,800	No. 6	2.27	1.13	0.756	0.454	0.227
	No. 4	2.83	1.41	0.943	0.566	0.283
	No. 2	3.39	1.69	1.13	0.678	0.339
	No. 1/0	3.93	1.96	1.31	0.786	0.393
	No. 4/0	4.64	2.32	1.55	0.928	0.464
7,200	No. 6	5.11	2.55	1.70	1.02	0.511
	No. 4	6.36	3.18	2.12	1.27	0.636
	No. 2	7.63	3.81	2.54	1.52	0.763
	No. 1/0	8.85	4.42	2.95	1.77	0.885
	No. 4/0	10.4	5.20	3.47	2.08	1.04
12,500	No. 6	15.3	7.65	5.10	3.06	1.53
	No. 4	19.1	9.55	6.37	3.82	1.91
	No. 2	22.9	11.45	7.63	4.58	2.29
	No. 1/0	26.6	13.3	8.87	5.32	2.66
	No. 4/0	31.4	15.7	10.47	6.28	3.14

It would be difficult to supply a welder having a 100-kva. inrush that would not produce a 3 per cent voltage dip on a 2,300-volt system. At 4,160 volts the situation is much improved, but 200-kva. inrush would involve difficulty. Even with 12,500 volts welders having a 1,000-kva. inrush could not be taken without giving a 3 per cent voltage dip unless they were favorably situated on the feeder. A 50-kva. welder could readily require an expenditure of $5,000 to rebuild a distribution circuit in order to eliminate objectionable voltage disturbances to lighting customers on the same primary feeder. Such a welder might have an annual consumption of 100 kw.-hr. per year rated kva. or 5,000 kw.-hr. annually. $5,000 × 12½ per cent ÷ 5,000 kw.-hr. = 12½ cents per kw.-hr., the cost of the burden placed on the distribution feeder to carry that load without disturbing other consumers. If the other connected power load is about 50 kva. the kw.-hr. consumption may be 100,000 kw.-hr. annually. Adding this to the welder load gives a cost of flicker correction nearly 6 mills per kw.-hr. based on the total load, and very probably makes the consumer who produced the disturbance an unprofitable one unless an adequate demand charge is included in the rate structure. Of course in the great majority of cases the power load may be of much greater proportion and the burden to relieve voltage disturbances not great enough to wipe out the profit, but nevertheless it is a very real reduction in profit and therefore a definite loss to the utility company. For this reason welding loads causing disturbances on the primary distribution feeder are sometimes served from motor-generator sets at a lower cost.

Seam Welder Supply

A study of Table II will reveal the limited ability of modern distribution systems to supply seam welders that give substantially a periodic flicker from 5 to 10 cycles which may have

[*Continued on page 114*]

Reduce Ground Resistances for Better Service

Continuous system-wide test and improvement of circuit grounding instituted to avert outages, blown fuses and burned-out transformers

F. M. HORTH, Erie Lighting Company

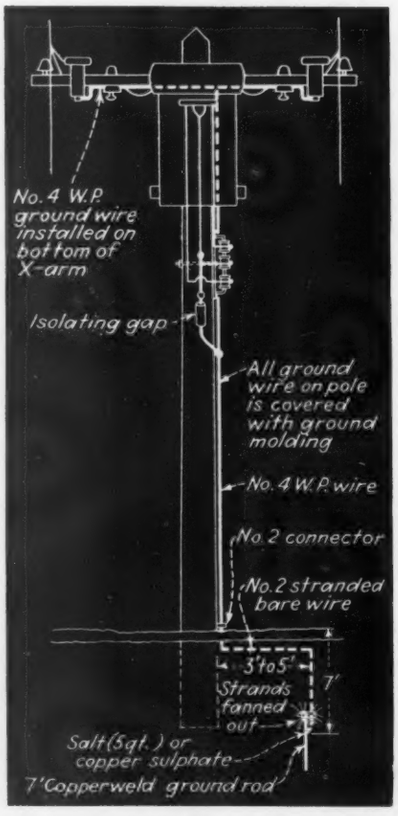
DISTRIBUTION grounds are being tested in a continuous program on the Erie Lighting Company system. Until the program was undertaken the severe lightning characteristics of the territory was occasioning an inordinate number of outages, blown fuses and burned-out transformers. Another adverse factor is the depth of sandy soil over most of the company area. Now, with a large percentage of the grounds rebuilt or relocated, the troubles amount to only two or three per storm, as against a former experience of 200 or even 300 in a single thunderstorm.

There was one 20-mile, 11-kv. line with an overhead ground wire which had ground rods every five poles. It was necessary to send a man out on the line during and after every storm. Now practically no trouble is experienced on this line because the grounds have been tested and their resistances reduced. Some were found to be up in the hundreds of ohms. Some of the old rods were pulled and moved to more favorable locations. There are now fewer ground rod installations than before, and all have been reduced to 25 ohms or less. It was the experience with this line which precipitated the present program of continuous testing.

Two men carry on this work over the seven counties in conjunction with such other operations as staking out lines, etc. About half their time is devoted to ground testing and ground improvement. It is also coordinated with acquiring field information for the continuous property inventory records. Once each year they cover all the 77 substation grounds. In the interim the arrester and neutral grounds are worked on. There is an arrester ground for each transformer installation. Wherever there are less than five grounded-secondary services from a transformer there is provided a primary neutral ground isolated from the arrester grounds. This applies whether the secondary ground is a rod ground or to the water system. An effort is made to get all the primary and arrester grounds below 25 ohms. Many can be brought down to 5 or 6 ohms. The tests are made with a type TH Borden groundometer.

If on a test it is found that a driven primary ground has more than 25 ohms resistance a new ground is installed at a distance 5 ft. from the pole. A 7-ft. hole is first dug with a posthole digger. Then a 7-ft. Copperweld groundrod (⅝ in.) is driven by means of a pole tamp to a 6-ft. depth below the bottom of the hole. Previously the rod has had attached to it by means of a ground rod clamp a 10-ft. length of No. 2 stranded copper wire. About a foot of wire is left below the ground clamp connection point so that it can be fanned out over the area of the hole. These fanned-out ends and the ground clamp are kept at least 5 in. above the salt to avoid excessive corrosion. It is important to make the clamp contact tight.

After the rod has been driven to the desired depth about 5 quarts of rock salt is placed in the hole. Then the diagonal trench is dug for the lead to the base of the pole and the rod hole backfilled at the same time. [*Continued on page 126*]

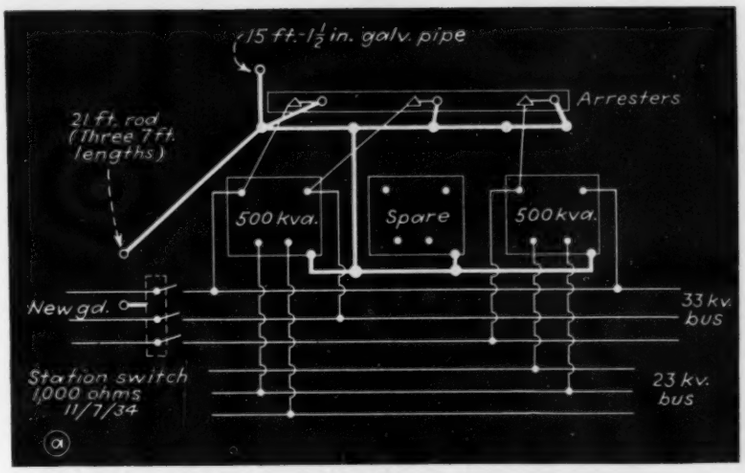

No. 4 W.P. ground wire installed on bottom of X-arm
Isolating gap
All ground wire on pole is covered with ground molding
No. 4 W.P. wire
No. 2 connector
No. 2 stranded bare wire
3' to 5'
7'
Strands fanned out
Salt (5 qt.) or copper sulphate
7' Copperweld ground rod

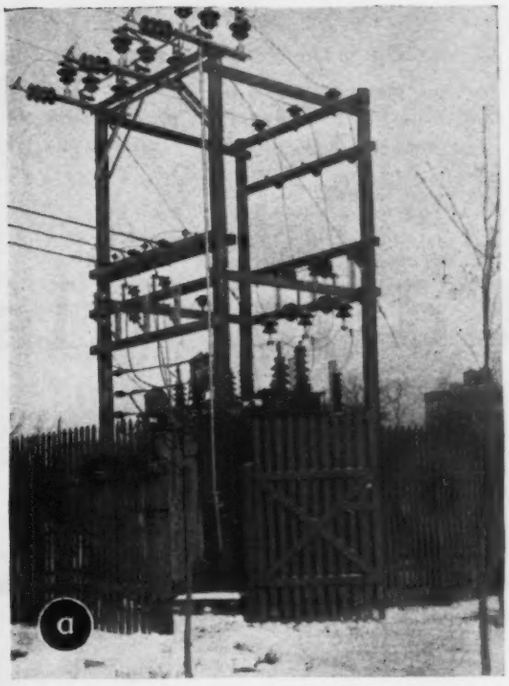
GROUND driven at bottom of 7-ft. hole

Located 5 ft. away from pole; stranded lead fanned out above rock salt for good conductivity. If there are less than five grounded services or grounds on secondaries an isolating gap is used between neutral on secondary and arrester ground.

When there are five or more grounds on the secondaries the neutral is connected to the arrester ground providing that the grounds are 25 ohms or less.

When there is only one customer served from a transformer there are two separate grounds—(a) neutral ground, (b) arrester ground—with an isolating gap between the two, the top of the gap being connected to neutral on secondary and the bottom of gap connected to arrester ground.



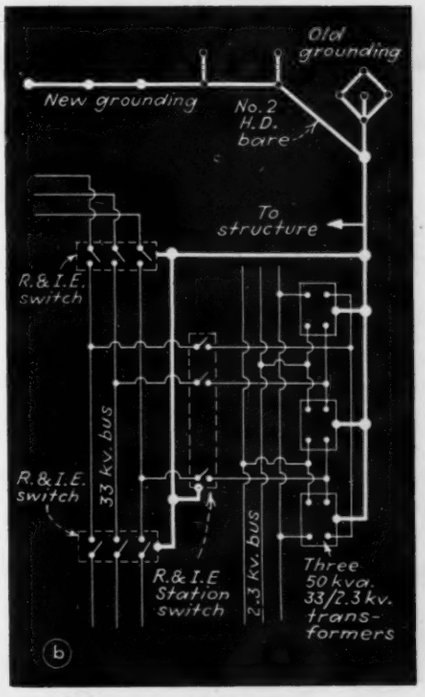


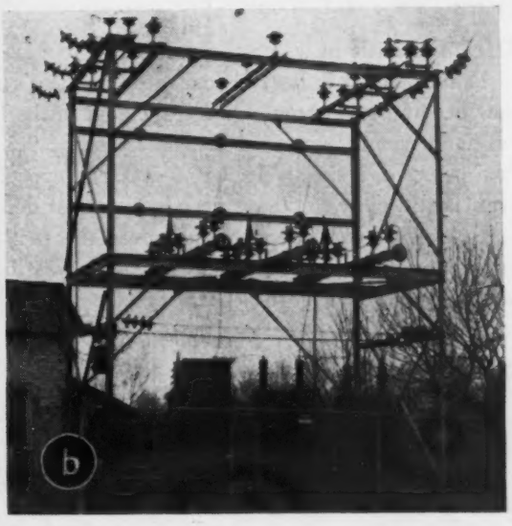
INCREASED grounding materially reduces station ground resistance

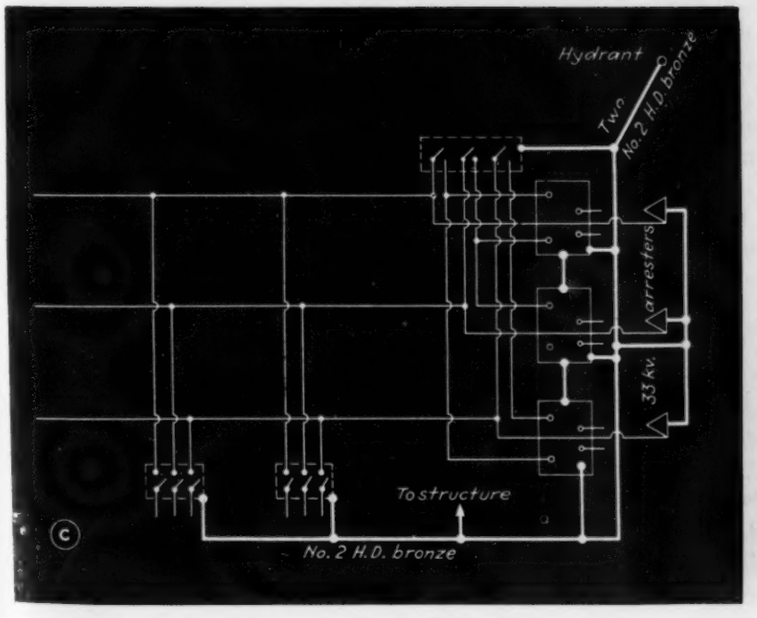
(a) Fifth Ward 33/2.3-kv. substation—formerly ground resistances on the station and transformer cases tested (1934) at 1,000 ohms. Since installing the new ground mesh the resistances (1935–1939) show a range from 8 to 18 ohms.

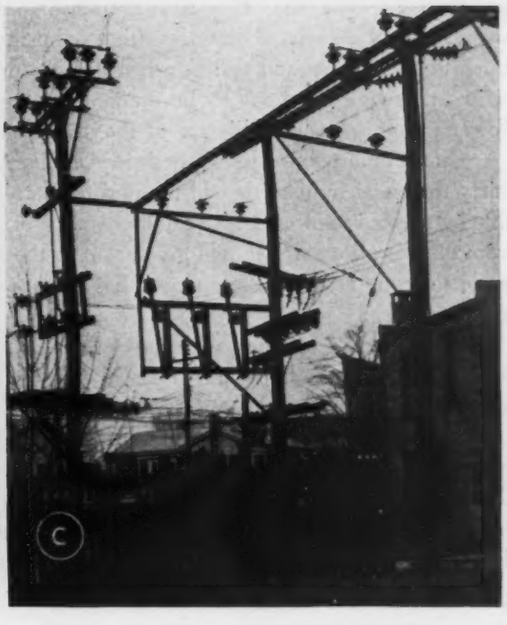
(b) McKean 33/2.3-kv. substation — Before installing the seven or twelve additional ground rods the resistance measured 200 ohms. Since adding them in 1935 the tests show 10 to 13 ohms. The row of rods is adjacent to a creek and they are placed about 6 ft. apart.

(c) Edinboro 33/2,3/4-kv. substation — In 1934 ground resistance tests on the station showed 400 ohms. Since installing the new grounding the resistance never is found to be more than 4 ohms and most of the time it is unmeasurably low.









Editorials

S. B. WILLIAMS, *Editor*

Reserves Ample

THE MANNER in which the utility industry is equipped to handle added industrial load at a moment's notice is now becoming apparent. Non-coincident peaks for June, July and August increased over last year by 9.4, 9.5 and 10.5 per cent, respectively. Gross installed capacity, however, is still close to 50 per cent in excess of demand.

Newspapers made headlines over the fact that the output for the second week in September was the second largest week on record. That was true, but then that isn't unusual. Last year we passed the previous peak in midsummer. The same thing happened in 1937, and in fact in every previous year on record when the industry was growing.

The increase in non-coincident peak in July was 2,340,000 kw. Since the rate of increase is rather rapid, there is every evidence of stimulation by preparedness and British war orders. However, the major part of this increase is not associated directly with war business. How much this extra demand will be when defense production is in full swing is about to be studied by the Federal Power Commission with the aid of the utility companies.

Questionnaires to be mailed in October to some thirty thousand industrials will be used to establish probable increases in power demand and energy uses. Returns from this questionnaire should give proof to the statement made so many times in these pages that the power industry is prepared.

In fact, the utilities will have so much reserve, counting present and the six or seven million kilowatts for 1940, 41 and 42 deliveries, that they will have to maintain an energetic load-building effort. This means that the industry which supplies the most universal of all raw materials will be able not only to handle the defense requirements but to maintain its regular peacetime services—something that few major industries will be able to do.

Priority and Price Warnings

EVERY NOW AND THEN statements are made by responsible people in Washington predicting priorities or regulation of raw material prices. For the most part these are probably anticipatory, but they should not be placed in the same category as wolf-crying. These warnings to industry should be taken seriously, for if they are not these controls will be slapped on industry so quickly as to make one's head swim.

Recently it was stated that the Navy was getting ready to invoke priorities in steam turbines and boilers. There is no question but what a two-ocean navy will need a tremendous amount of steam-generating capacity, but there is still plenty of manufacturing capacity to take care of the ships for which there are available shipbuilding facilities. Also extensions to manufacturing capacity are well in advance of additional shipway capacity. The Navy, however, is serving warning that it is not going to allow anybody to get in the way of its program.

Likewise, the admonition from Henderson of the Defense Commission with regard to metal prices is a warning that prices must be kept under control. The concern of the "watcher-of-prices" is not so much that prices go up as that the balance between raw material prices and those of finished products, and labor wage rates, and farm commodity prices get no further out of adjustment.

If all buyers will keep from being panicky and order normally, there is little likelihood of our industrial production program and our price economy getting out of control. If this balance can be maintained, there not only will be no need for further government regulation but there will be less readjustment required when this preparedness economy will have passed.

Benefits from Distribution Transformer Standardization

THE ECONOMIC BENEFITS sought in the standardization of distribution transformers are going to be attained by the manufacturers or the utilities directly in proportion to the extent of field acceptance. These new standards which came through joint action on the part of the NEMA transformer group and an EEI committee, while bringing a lower price on January 1, do not automatically lower manufacturers' costs; in fact, at the moment they raise them.

It was expected that the new standards would result in a greatly lessened demand for other types and for specials, and in all likelihood they will. Obviously it is yet too soon to expect a great deal, especially as the manufacturers are not yet tooled up for all sizes. On the other hand, so long as the demand by utilities for transformers incorporating the new standards is small, there is little justification for substantially lower prices.

As it now stands the new standards, instead of simplifying manufacturers' stocks, have increased the catalog

numbers, causing, if anything, higher manufacturing costs. When this is considered, together with the fact that distribution transformer prices as the result of keen competition, especially for the REA business, have been below par, it is obvious that users are not going to secure the full price benefits of this standardization program until the demand is sufficient to bring manufacturing economies.

Unfortunately, committees representing the membership of an association seldom are able to commit their constituents to any action. A committee is given the responsibility of negotiating a mutually acceptable standard. Once that is done, the committee may withdraw and let nature take its course, or it may feel a certain obligation to sell the idea to its people. While this puts an additional heavy responsibility on the shoulders of a small group of men, under accepted association procedure there apparently is no other way to secure resulting benefits reasonably quickly. However, it seems to work, for in other programs the acceptance has been large and reasonably prompt.

Considering the benefits resulting from previous standardization and products simplification programs that came through similar negotiation, such as with meters, there is every reason to believe that the present program on distribution transformers will start to build up momentum next year.

Highway Safety Efforts Pay Dividends

HOW FAR should utilities interest themselves in highway safety apart from the training of their own drivers and apart from better lighting for night driving? In Dallas Texas Power & Light apparently believes in going all the way, for one of its men has been head of the local civic group and of the state organization the work of which is aimed at reducing road fatalities and accidents.

Does it pay? Such injuries have been reduced in Dallas almost 60 per cent in the past five years, the commercial vehicle insurance premiums for the city have been reduced 25 per cent and private vehicles 11 per cent. Considering the number of commercial vehicles the ordinary utility employs this saving alone would justify the time and expense.

There are other benefits, however, which bring the total on the plus side up considerably. Reckless driving results in considerable damage to utility property. Poles and lamp standards suffer most. Some of this at times can be reclaimed from the offenders, but never the entire cost, including loss of service.

Accidents and fatalities cost a city the size of Dallas millions each year. Since in almost every community the local utility is generally the largest single taxpayer, it means that the company is paying a substantial part of this cost.

There are numerous other real, though perhaps less tangible, benefits to be secured by utilities from a reduction in street and highway accidents, but those mentioned seem sufficiently great to warrant an active interest on the part of every utility. It isn't enough to train one's own personnel. The greater benefits, let alone the good will that can be created, come from taking the leadership in setting up a local safe driving program for everybody.

What Chance Power-Generation Standardization?

FROM TIME TO TIME there have been pointed out in these columns the advantages to be gained from standardization in the design of power-generating equipment. While some steps have been taken in this direction with some results, evolution in the art and science of power development disregards these attempts at standardization. Under the impetus of increasing coal prices and further technical progress central-station design is still in a state of flux.

Standardization of steam pressures and temperatures has been effected for moderate conditions, but increased coal prices may warrant higher pressures In fact, higher pressures and temperatures than now in average use may be expected in new stations.

The advantages in size, weight and economy of steam turbines of higher revolutions per minute led to the adoption of 3,600-r.p.m. units for capacities up to about 65,000 kw. Above this size units are not only difficult to build but appear to have little advantage in steam consumption over 1,800-r.p.m. units. Nevertheless, still higher pressures will favor the 3,600-r.p.m. designs.

One may say that there are no standard designs for large high-pressure steam generators. No plant equipment has changed as much as the steam boiler and its accessories. Practically every installation is "tailor-made" at present. The end is not yet in sight, for forced circulation boilers are being introduced, and this must lead to still further changes.

Improvements in steam generators have led to developments in superheaters, economizers, air heaters and boiler feedwater treatment and conditioning. New alloys are under development for higher steam temperatures. Other alloys may make it possible to recover more heat in air heaters when coal prices make their use economical. Engineers are slowly gaining correct knowledge of proper feedwater and how to secure it. Even the troublesome silica is being removed with some degree of success.

Another highly important advance has been the wide adoption of means to clean chimney discharges. Many of these devices are still under development. This costly addition to plant equipment is a social gain of great value.

In view of these changes to which brief reference has been made, it would appear that plant standardization, in spite of its many advantages, will not be achieved until the present trend in development has run its course. But will this ever occur? What new method of power development may be "just around the corner"?

Let the People Decide

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

IT IS rather interesting that the Japanese war scare, sprung on a nation for the most part surprised on September 27, but predicted by Senator Burton K. Wheeler on September 13, came right after Wendell Willkie's speeches on electric power in the Northwest. More accurately, it came as quickly after Willkie laid down his doctrine for Bonneville and any other big government dam project as reports on the results of these declarations could reach Washington and be appraised.

Now it may be that there is not the slightest connection between the two things. But there are those who think there is a very real connection. No effort will be made here to prove it. The point of interest is why people are talking about it.

Before getting to that it should be remembered that Gen. Hugh Johnson has predicted not once but several times in the last few months that if Roosevelt becomes convinced that Willkie has a chance for election, FDR will plunge this country into war. Johnson has also predicted that if FDR is re-elected he will have the country in the war within two weeks after the election. But the first prediction is the one that is being mentioned in connection with Willkie's power speeches.

Unexpected Jolts

The point, of course, is that the New Deal had counted confidently on the hundreds of millions of federal money poured into Northwestern power projects to make all those states, but particularly Oregon and Washington, safe for the third term. Surprise No. 1 came with the nomination of Charles L. McNary of Oregon for vice-president.

But the real jolt was when Willkie promised the people of the Northwest that he would complete the big power projects, if elected, and that he favored letting the people in each community decide whether they would have the power distributed by a government ownership body or by a private company.

All the reports from Oregon are that, assured of the continuing flow of federal funds for the present, and of what they believe to be the big drawing power for factories and development in general these electric plants will exert, Oregon and Washington are no longer a certainty for the New Deal. Also, that the New Deal has lost a certain amount of pulling power in other sections of the country, in some of which public power is an issue, and in some of which water power development is a hope.

Not only that, but Willkie has repeated his performance which so surprised the country in general and the electric industry and the New Dealers in particular when, as head of Commonwealth & Southern, he managed to put the Administration in the position of being grossly unfair.

On that occasion, it will be recalled, Willkie embarrassed President Roosevelt and David E. Lilienthal of TVA enormously when he proposed, one after the other, several methods of arbitrating the differences over price if the government was to take over the Tennessee Electric properties.

One offer was to let the President name one of the umpires, Willkie another, and a third off the Supreme Court!

The timing of this was beautiful, because Roosevelt's most recent appointee to the high court at that time was Hugo Black, one of the most radical opponents of the electric industry in the Senate.

When this produced no action Willkie suggested that the SEC would be acceptable to arbitrate the dispute.

These offers so worried the New Deal, because they looked so obviously fair to the country, that many think they are responsible for the government paying Willkie's company a price which, while no business man has ever criticised it as being too much, was regarded by John Rankin, head of the power bloc in the House of Representatives, as outrageous.

Willkie has done it again, and again to the embarrassment of the pro-public ownership group.

This time he wants the policy of permitting each local community to decide whether it wants to be served by public or private power, with the only restrictions that the rates be kept down.

Of course that is precisely what Norris, Rankin, Cohen, Corcoran, Ickes and Roosevelt do not want. They don't want the people to have their choice. They want the Hitler type of referendum when public power is the subject. It is the old human desire to make your neighbor do what you think is good for him whether he likes it or not.

Look at the San Francisco situation, where the people have voted time after time, every time it has been proposed, against issuance of bonds to provide a publicly owned electric system. Does Honest Harold think those people around the Golden Gate should be permitted to decide whether they want a public or private electric system in their city?

People's Decision Not Wanted

Of course, Ickes is right on the law in this particular case. Congress did write into the Hetch Hetchy bill a provision which seems to bar privately owned companies. But has Ickes asked Congress to change that law so that, in this supposedly democratic country of ours, the people of San Francisco can have what they want?

It hasn't even occurred to him.

But reports from various sections interested in power developments are to the effect that quite a few people, even those favoring government ownership, agree with the Willkie declaration in favor of letting the people of each community decide whether they shall have government or private ownership of their local distribution systems.

NEWS OF THE WEEK

Wisconsin Electric to Speed New Construction

Officials break ground for $7,000,000 addition to Port Washington station — Co-operation of manufacturers and contractors will put Commerce Street generator on the line ahead of schedule

In anticipation of increased power requirements due to the national defense program, Wisconsin Electric Power Co. is pushing ahead the construction of its 35,000-kw. Commerce Street power plant addition and has started excavation work for an 80,000-kw. addition to its Port Washington station. For details on the latter see ELECTRICAL WORLD July 27, 1940, page 55.

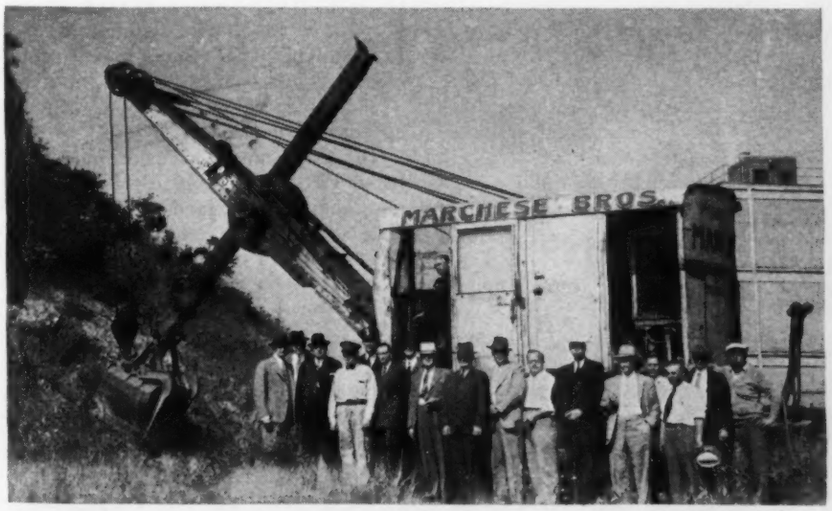
When the Commerce Street addition was projected, more than a year ago, construction plans were made flexible to permit completion of the unit either in the fall of 1941 or the fall of 1942. The recent rapid development of national defense plans, however, has made it advisable to move the completion date ahead as much as possible. Co-operation has been promised by equipment manufacturers and contractors and indications now justify the hope of placing the new 35,000-kw. unit in service some time next summer.

Company Breaks Ground

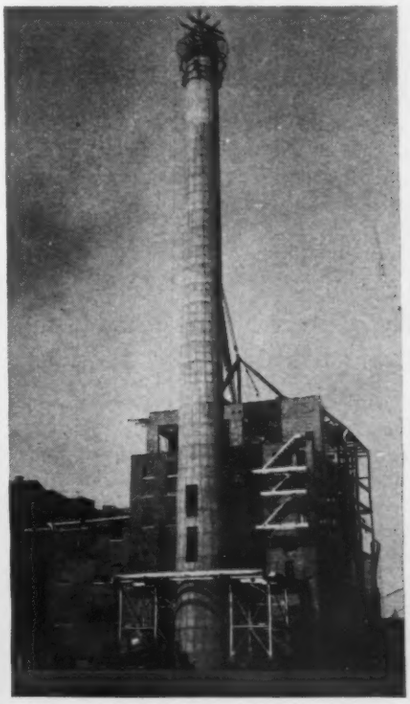
In an informal ceremony held recently, Port Washington city, Ozaukee county and state officials joined representatives of the company in witnessing the breaking of ground for the Port Washington power plant addition. This addition, estimated to cost about $7,000,000, will consist of a second 80,000-kw. turbo-generator and high-pressure boiler, together with necessary auxiliaries. The new unit will incorporate numerous refinements over the present 80,000-kw. installation at Port Washington, which already holds the world's record for steam power plant thermal efficiency.

In announcing plans for the Port Washington plant addition, S. B. Way, president of the company, said:

"We feel it is our duty to the public we serve to be able to meet unusual or even emergency demands for power that are likely to arise through national defense preparedness. For that reason we are building not only for the in-



BREAK GROUND FOR PORT WASHINGTON—City, county and state officials and representatives of Wisconsin Electric Power Company join Vice-President G. G. Post in breaking ground for addition to house second 80,000-kw. unit at Port Washington



COMMERCE STREET PROGRESSES—The 300-ft. stack for Commerce Street plant addition nears completion as part of $4,137,000 expenditure involving new 35,000-kw. unit for Wisconsin Electric Power

PHOTOELECTRIC CELLS FOR SODIUM—Photoelectric cells control system of G.E. 10,000 lumen, sodium lamps mounted in airplane shape reflectors at 25-ft. height, and recently installed on U. S. Route 66 near Springfield, Ills. Thirty-six luminaires are used to protect two important junctions as part of State safety campaign

creasing needs of today and tomorrow, but for greater demands which may reasonably be expected to arise from acceleration of industrial activity in America's rearmanent program."

More Transformer Capacity

The company recently placed an additional 90,000-kva. bank of transformers in service in its 132,000-volt 28th Street substation, which serves a great part of the Milwaukee industrial area. Near future plans call for the addition of 60,000 kva. of transformer capacity at the 132,000-volt Granville substation and construction of a second high-tension transmission line between the Port Washington power plant and Granville.

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New Haven Company Gets Right-of-Way for Link

United Illuminating Co., New Haven, Conn., has negotiated with the New York, New Haven & Hartford Railroad for use of the right-of-way between Bridgeport and New Haven for construction of a high-voltage transmission line linking power plants in New Haven and Bridgeport for interchange of electric power. The plant at Bridgeport now has 85,000 kw. of generating capacity, while the New Haven capacity is 75,000 kw. The Bridgeport plant will shortly be increased by 25,000 additional kilowatts.

Under the planned construction, which will be completed by April, emergencies can be attended to when trouble arises in either city. Oil storage tanks will also be installed at Bridgeport's Steel Point plant to assure continuation of operations if difficulty is encountered in using the pulverized coal system of firing.

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New 43,000-Kva. Unit for Devon Plant

Connecticut Light & Power Co. plans an expenditure of $4,000,000 for immediate expansion. The project will include an increase in generating capacity of 43,000 kva. Directors and officials of the company conferred September 30 with engineers and it is expected a contract for the work will be announced soon.

In addition to additions to central power plant facilities there will also be enlargement of substation and transmission lines to carry the extra load. President Charles L. Campbell issued the following statement:

"Connecticut's industries play a most important part in the manufacture of materials essential to a well-planned program of national defense and we are anxious to be prepared to deliver all the power needed. It is principally for this reason that the Connecticut Light & Power Co. is planning additions to its generating capacity."

The generating unit, ordered from Westinghouse Electric & Manufacturing Co., will be installed in a proposed plant addition at Devon. Additions will also be made to the Devon substation and to substations in other load centers, as well as statewide improvements to transmission lines.

FPC Charts Power for Defense Areas

Federal Power Commission has completed the first of a monthly series of surveys of the electric power industry for national defense purposes. The charts, divided into districts representing integrated power pools or natural geographical areas, are based upon replies to questionnaries sent out last July.

This first study is not to be made public on the ground that it virtually represents a "trial heat" of FPC's new program of charting the trends of power consumption and peak loads, in relation to assured normal capacity and dependable capacity. A number of the calculations are held to be subject to modification as a result of conferences with the companies involved—conferences which are to be held before the chart based upon August reports is prepared. The August reports are expected to be made public in October to show the industry's generating capacity to meet additional loads resulting from defense orders.

The charts not only show present generating capacity in each district but indicate future increases based upon orders for additional installations. They relate to this the actual power consumption and load peaks for the last year as well as estimated figures for three months ahead. The first report contains no interpretive comment by FPC, but subsequent studies probably will contain such an analysis.

In addition to charting aggregate figures, the FPC, in this same questionnaire, obtained from utilities lists of all their major power customers, together with data showing the ratio of each one to the company's whole output, in an attempt to simplify the problem of determining the correct effect upon a company's operations of a sudden jump in operations of any specific power user.

To the industrial concerns thus listed FPC plans soon to send another questionnaire designed to make possible the accurate relating of specific defense orders to power requirements.

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Dismisses Rate Charges

Pennsylvania Public Utility Commission has dismissed the complaints of thirteen industrial consumers of Metropolitan Edison Co., Reading, which alleged that the utility's rates are unjust, unreasonable and constitute an unfair preference to consumers in other parts of Metropolitan Edison territory engaged in the same or similar business.

Comprehensive Surveys Mark Indiana Sessions

National defense program for electrical industry, preservation of democracy, development of customer understanding, new frontiers for appliances and transformer design trends featured at convention of Indiana Electric Association

Notably keen observations covering a comprehensive range of industry problems in the fields of economics, national defense, public relations, valuation accounting, merchandising and apparatus design held the attention last week of nearly four hundred delegates gathered for the annual convention of the Indiana Electric Association at French Lick, Ind.

A threefold program for the electrical industry under national defense was proposed by Chester H. Lang, General Electric. It is the obligation of the industry, as well as his own company, Mr. Lang said, to (1) serve the country to the limit of its ability, (2) do so without detriment to the quality of service to customers and (3) build faith in private enterprise by telling the story of industry's effort in national defense in simple, straightforward fashion. "Our fate," he stated, "may well lie in what the public thinks of the way we handled ourselves when their skins and ours were at risk." The public will never know what we are doing unless we tell them in terms that they can understand and appreciate, he stated.

For "Vocal" Industry

In a rousing defense of the American system of free enterprise, C. E. Swartzbaugh, president of the National Electrical Manufacturers Association, warned industry that it must soon become vocal if it is to improve its present position. "American industrial institutions," he said, "are greater than their products, and it will be the fault of industry if the public damns the institution but accepts the product." The fact that the American economic system is not perfect is not an excuse to destroy something that has given us the highest standard of living of any country in the world, he declared. With the living standards of other countries being destroyed by war, the defense of commercial enterprise in this country is the defense of civilization.

Urging the utility industry to know its customers better, S. B. Williams, editor ELECTRICAL WORLD, suggested that companies study the interests and forces influencing the attitudes and behavior of customers and employees and to build around these interests a unified, co-ordinated, public policy for the whole industry that would build customer understanding.

Appliance Frontiers

In discussing frontiers for electrical appliances, W. H. Thompson, Westinghouse, pointed out that with only 15 per cent of electrified homes using electric ranges and only 4 per cent using electric water heaters, the frontier of the electrical industry is quite obviously the unsold appliance market. This frontier demands aggressive selling of ranges, water heaters, refrigerators, dishwashers and air conditioning if the electrical industry is to increase the American standard of living, Mr. Thompson declared.

Trends in power transformer design enumerated by L. H. Hill, Allis-Chalmers, included as most significant the tendency to design transformers to withstand lightning. Also mentioned was the adoption of load ratio control for large and more recently for small transformers, wide use of inert gas protection, design of regulating transformers for higher voltages, widespread use of multiple-winding transformers, and transformers with forced air circulation. Mr. Hill also mentioned the intensified efforts to reduce noise levels in large transformers.

A. E. Schanuel, National Adequate Wiring Bureau, called for the co-operation of architects, bankers, utility men, contractors and electrical dealers in the promotion of adequate wiring. Mr. Schanuel specifically urged that special efforts be directed toward the speculative builder field, hitherto given but little attention.

H. T. Pritchard, president of Indianapolis Power & Light Co., was chosen to head the association during the coming year at a meeting of the association's directors. Mr. Pritchard, who has been vice-president of the state association during the last year, will succeed R. A. Gallagher, president of Public Service Co. of Indiana, with headquarters in Indianapolis.

W. Marshall Dale of Fort Wayne, president of Indiana Service Corp., was elected vice-president, and Roy E. Blossom of Indianapolis was re-elected secretary-treasurer.

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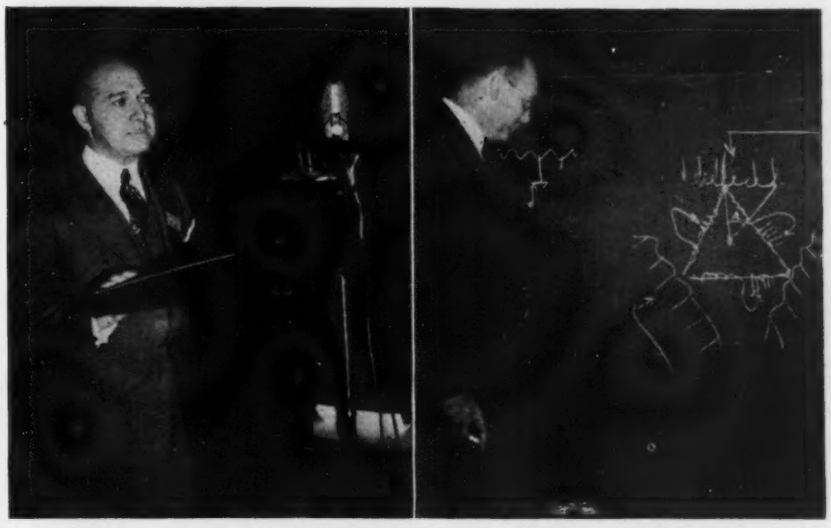
FPC Fixes Original Cost on Pacific Gas Project

Federal Power Commission has determined that the actual legitimate original cost of Project No. 187 of the Pacific Gas & Electric Co. was $1,361,409 as of September 30, 1924, and has ordered the company to record this figure as the basic amount in its fixed capital account as of that date.

The project is located at Bullards Bar, on the north fork of the Yuba River, in California. The company has been directed to submit within 90 days the required form showing compliance with the order.



AT INDIANA CONVENTION—H. T. Pritchard (left) president Indianapolis Power & Light Co., was chosen to head Indiana Electric Association for the coming year. Lee H. Hill (right) of Allis-Chalmers explains new trends in transformer design

Excess Profits Misnomer Says Utility Executive

Kansas City Power & Light president sees increased rates as result of mounting taxation — Company studying plans for another 35,000-kw. generator and increased boiler capacity

Utilities are limited by law to earn but a fair return on their properties, yet executives who have studied the new tax bill declare that they are being hit with a so-called "excess" profits bill when they do not have "excess" profits.

Chester C. Smith, president of Kansas City Power & Light Co., declared, in an interview with ELECTRICAL WORLD, that it appears to him that his company will be unable to absorb the proposed tax. He said that his company, through rigid economy, has been hard put to absorb the present property, state and federal income tax, which total has been increased from 18 to 20.9 per cent. He said that the new federal tax might run 25 per cent of normal taxes.

It is likely that some of the smaller utilities may be forced to seek relief from the new tax by asking the state public service commission for an increase in electric and gas rates. Should this be accomplished, it is indicated that some of the larger utility companies will follow suit. In this case the public will be called upon to bear part of the new tax to meet the cost of the national defense program.

New Plant Addition

Kansas City Power & Light now has under study plans for the installation of a new boiler and a 35,000-kw. turbo-generator to be installed in the Grand Avenue station some time during 1941. Engineers have not, as yet, completed plans as to the size of the boiler. The company also plans expansion of facilities in Mason City, Iowa, but no conclusions as to the extent of the work have been reached, Mr. Smith stated. The company recently put into operation a 35,000-kw. G.E. unit in the Northeast station.

Discussions are under way looking forward to a new financing program. This would include the selling to the public of 4 per cent preferred stock at about $104 a share. The proceeds would be used to redeem the outstanding $6 preferred stock, the retirement of $1,000,000 of bank loans and to finance expansion of facilities. Mr. Smith said that bond financing is not being considered as he feels that the $38,000,000 of bonds sold to eight insurance companies September 1, 1936, is about the right proportion of bonds for the company's capital structure.

Mr. Smith said that there will probably be some interconnections made by his company as a result of integration proceedings of United Light & Power now before the SEC. He feels that Kansas City will be the hub for the holding company system.

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Legislation Fosters TVA for the West

Legislation creating a permanent Columbia Power Administration to operate Bonneville and Grand Coulee and with authority to take over entire utility systems was introduced in the House this week, a natural sequence in the New Deal plan to carve another TVA in the Pacific Northwest.

The legislation gives the proposed CPA authority to buy or acquire distribution systems, including generating plants, and to sell such systems to public agencies providing electric service as substitutes for private companies. Chief objective is the acquisition of Puget Sound Light & Power Co., which Washington State's quarreling PUD's have been unable to purchase, singly or together, at their own terms. The proposed CPA, incidentally, would be a regional agency in the Interior Department, not independent such as TVA.

Introducing the bill, Representative Charles H. Leavy, Washington Democrat, had printed in the Congressional Record a long letter from Secretary Ickes approving the measure and stating that President Roosevelt has approved its objectives. The bill, prepared by the Interior Department, was rushed into the House hopper before election in the hope that it would help defeat Public Intiative 139 in Washington State next month, but without any expectation of Congressional approval in the immediate future.

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Japan Plans 16 Power Plants by End of '41

Electrical Board of Communications Ministry of Japan has recently approved plans for the construction of six new hydro-electric and ten new steam stations, according to the *Electrical and Radio World Trade News.* Plans call for the completion of six stations before the end of 1940 and the balance by the end of 1941.

Negotiations are reported under way for the establishment of two new electrical manufacturing companies by the Tokyo Electrical Light Co. and the German firm of Allgemeine Elektrizitats Gesellschaft. AEG will invest one-third of capital in kind by contributing machine tools and engineering technique, while the balance of anticipated capital of 50,000,000 yen will be subscribed by the Tokyo Electric Co.

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Utilities Well Prepared, Editor Tells Inspectors

If the Army, Navy, ordnance and air forces were as well prepared for national defense as are the electric utilities, the international picture would be quite different, S. B. Williams, editor of ELECTRICAL WORLD, last week told the Electric Association of Kansas City and the delegates to the Annual Convention of the Western Section, International Association of Electrical Inspectors. This was the largest attendance ever registered at any meeting of electrical inspectors.

Not only are the utilities prepared to handle the load with a 50 per cent reserve and millions of kilowatts of generating capacity on order, Mr. Williams stated, but they are prepared with a personnel trained to act in emergency, prepared to prevent sabotage and prepared with coal and other essential supplies and materials.

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Manufacturers' Medal to Hughes of Hotpoint Co.

The committee of judges appointed by N.E.M.A. announces this week that it has selected George A. Hughes, chairman of Edison General Electric Appliance Co. of Chicago, to be the recipient of the James H. McGraw Award Manufacturers Medal.

Presentation with a citation will be made during the annual meeting of N.E.M.A. in New York the latter part of this month.

•

Hartford Orders Gas-Filled Cable

In connection with the development of transmission facilities to furnish increased blocks of energy to certain areas, the Hartford Electric Light Co. has ordered 18,600 ft. of three-phase, three-conductor gas-filled cable from General Electric, and the initial in-

stallation will be made between the South Meadow generating station and the Laurel Street substation. The rated voltage is 27.5 kv. There will be 16,500 ft. of 500,000-circ.mil cable and the balance will be 600,000 cir.mil, the larger size to be used in duct sections where conditions are relatively crowded.

The cable will be of the manufacturer's type H shielded design, with 133 mils of lead covering and 240 mils of paper insulation. Nitrogen gas will be used.

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Governor Condemns Bonneville Methods

Dictatorial methods of the Bonneville Administration are doing more to prevent the rapid growth of public utility districts in the states of Oregon and Washington than any opposition which may come from private power companies, in the opinion of observers who are fostering public ownership.

Gov. Rufus Holman of Oregon expressed the views that the people should have what they want and each community should determine the question whether they want private or public power to serve them. He said that he would use what facilities are available and avoid duplication so that the customer would obtain maximum benefits. "I want to be fair on every occasion," he declared.

"In some instances the public is better served by private utilities and I think public capital should not be put into use to parallel private systems," Governor Holman declared.

Governor Holman has been working with Bonneville and Grand Coulee authorities and the private utilities in the area in the hope of evolving a cooperative instead of an antagonistic approach to the delicate power question in the Northwest. He said that so far efforts have produced encouraging results.

There should be no dismemberment of a private utility piecemeal, Governor Holman declared in an interview with ELECTRICAL WORLD. "Bonneville should have an opportunity to make a fair proposal which is mutual to all interests," he said. "It should buy out entire systems so as to preserve invested capital and not cause financial loss to investors."

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Alaskans Favor City Unit

In a recent special election in Sitka, Alaska, voters submitted a four-to-one vote for municipal ownership of utilities. The city plans to issue $200,000 in bonds to purchase and improve the Sitka Wharf Power Co.

New York Utilities Prepared for Demands

Prezzano tells Empire State Association companies well equipped for defense program needs — Lighting developments, farm programs, utility war experiences and management problems discussed

The electric and gas utility companies of New York State are better prepared now with facilities and trained personnel than ever before to cope with all demands for service arising from preparations for national defense, Edward P. Prezzano, retiring president of the Empire State Gas and Electric Association, told 300 members gathered at Westchester (N. Y.) Country Club last week for the 35th annual convention. The utility companies, he stated,

Irving K. Peck of Binghamton, N. Y., new president of Empire State Gas and Electric Association

pledge all of their efforts to maintain "the American concept of democracy with freedom and opportunity to all."

Needs of the human eye for adequate indoor lighting are being met only to the extent of 3 per cent by present-day lighting installations, David S. Youngholm, vice-president in charge of the lamp division, Westinghouse Electric & Manufacturing Co., told his hearers.

For eight years, Mr. Youngholm said, the public has been told and retold the story of Better Light for Better Sight and sales of incandescent lamps have increased along with the tremendous growth of fluorescent. For 1940 it is expected 575,000,000 incandescent lamps will be sold, compared to 531,000,000 in 1939. Fluorescent sales for 1940 will be 7,500,000, he predicted, compared to 2,500,000 two years ago.

The average wattage sold, he said, is decreasing in the 60 watts and under sizes, increasing in 100 watts and larger sizes. Fluorescent is not cutting in so much on utility income, Mr. Youngholm concluded, and with continued utility assistance he predicted "a golden age in lighting is soon to follow."

Utility companies which wish to serve the farmer should invest time in studying his needs, said H. E. Babcock, chairman board of trustees, Cornell University. Rural service engineers are great farm relations experts, Mr. Babcock declared, and said their understanding service to farm customers was changing the attitude of farm people toward utilities. Expansion of electric rural usage per customer will not only improve the companies' financial report, he said, but can vastly improve relationships between utilities and the farm.

Speaking informally, Floyd L. Carlisle, chairman of the board, Consolidated Edison Co. of New York, said "that we should always remember that there is only one purpose for our being in business. It is to render gas and electric service to the public on a basis that is sound to us and sound to our customers."

Regulatory and tax and political matters absorb so much time, Mr. Carlisle said, that utility men should keep in mind this major objective by frequently reaffirming it.

The men and women of New York public service companies have built up a usage of electricity greater than that of any other place on earth, said the speaker, and due to these efforts great cities have come into being, industry has flourished and the typical American family has enjoyed the highest standards of living in the world.

The effect of the European war on utility companies abroad was discussed by Dannie Heineman, president Societe Financiere de Transports et d'Enterprises Industrielles. Belgian utilities dismantled their turbo-generators before the invasion, he said, but many are again in operation, and the destruction of power plants by bombing has been less than might be expected.

Emmet F. Connelly, president of the Investment Bankers Association, termed the present bond situation a "seller's market." Utilities must guard against over-pricing new and refunding issues.

Officers elected for the ensuing year are: Irving K. Peck of Binghamton, president, and John S. Haley of Syracuse, vice-president.

Commission Seeks Price-Rise Check

The blast from Leon Henderson, commodity prices watcher on the defense commission, at ballooning prices for copper, zinc and lead can properly be labeled "anticipatory." What the commission seeks to do by this, and related statements aimed at other commodities from time to time, is to halt before it gets a good start any runaway skyrocketing of prices.

Defense commission attempts to blockade unwarranted price kiting in copper is of first importance to the electric utility industry, heavily dependent upon this metal.

One of the principal concerns of the defense commission—particularly of Henderson's division—is that prices of key commodities will get far out of line by sudden short-term demands for defense needs, and thus promote hysteria buying by normal consumers fearing a shortage. The commission's first line of attack on such spiraling will be statements giving the facts.

Thus, in this instance, the defense commission statement reports that recent price flurries resulted from some consumers attempting to cover long-term requirements, that certain firms with seven to eight months supply on hand have been observed in the market as well as "certain foreign countries" (Japan), that there are ample stocks and domestic supplies, that refining capacity is on the increase, that capacity could be readjusted in several ways and that profits are ample and costs do not seem to be rising.

The effectiveness of such statements, of course, will be in direct ratio to industry's faith in the defense commission. But the commission, indirectly at least, has other recourse if voluntary appeals fail.

In the case of copper, an embargo could shut off sales to Japan—this may come anyway, for other reasons than price control; the competitive position of aluminum for heavy conductors could be publicized; the President could restate his belief in the 12-cent copper ceiling, or, finally, in an extreme situation, the commission could push for removal of the 4-cent excise tax on imported copper.

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Hopson Report Completed by Power Commission

An investigation by the Federal Power Commission of six Pennsylvania subsidiaries of Associated Gas & Electric system has been made public and summarizes in particular the activities of Howard C. Hopson and his associates.

Alleging inflation of fixed capital accounts and operating expenses, the commission has ordered that the report be made available to regulatory bodies and will send copies to 27 state commissions in Associated System territory.

MEETINGS

National Safety Council—Annual congress and exposition, Stevens Hotel, Chicago, Ill., October 7-11; public utilities section, Tuesday Afternoon, October 8 and Thursday Afternoon, October 10. W. H. Cameron, managing director, 20 North Wacker Drive, Chicago, Ill.

Edison Electric Institute — Electrical equipment committee, Jefferson Hotel, Richmond, Va., October 7-8; transmission and distribution committee, Henry Grady Hotel, Atlanta, Ga., October 14-16. H. S. Bennion, managing director, 420 Lexington Av., New York, N. Y.

American Institute of Electrical Engineers — Middle Eastern direct meeting, Cincinnati, Ohio, October 9-11; winter convention, Philadelphia, Pa., January 27-31. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

National Commercial Electric Cooking Council —Fourth annual conference, Hotel Knickerbocker, Chicago, Ill., October 10.

International Municipal Signal Association—Annual meeting, Roosevelt Hotel, Jacksonville, Fla., October 14-17. Irvin Shulsinger, secretary, Eight East 41st St., New York, N. Y.

Porcelain Enamel Institute—Annual forum, University of Illinois, Urbana, Ill., October 16-18.

American Welding Society—Annual meeting in conjunction with the National Metal Exposition, Cleveland, Ohio, October 20-25. Miss M. Kelly, secretary, 29 West 39th St., New York.

National Electrical Contractors Association—Fall meeting, George Washington Hotel, Jacksonville, Fla., October 21-23. L. W. Davis, general manager, 420 Lexington Avenue, New York, N. Y.

National Electrical Wholesalers Association — Semi-Annual convention, Hotel William Penn, Pittsburgh, Pa., October 22-25. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

National Electrical Manufacturers Association — Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 27-November 1. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

National Research Council—Conference on Electrical Insulation, annual meeting, Washington, D. C., October 31-November 2. Thorstein Larsen, secretary. Consolidated Edison Co., 55 Johnson St., Brooklyn, N. Y.

Wisconsin Utilities Association — Annual convention, electric section, commercial and technical divisions, Hotel Pfister, Milwaukee, November 11-12. A. F. Herwig, executive secretary, 135 West Wells St., Milwaukee, Wis.

Adequate Wiring Conference—Sponsored by the National Adequate Wiring Bureau and the International Association of Electrical Leagues, Palmer House, Chicago, November 12.

International Association of Electrical Leagues—Annual conference, Palmer House, Chicago, November 13-14. O. C. Small, secretary, 155 East 44th St., New York, N. Y.

Illinois Public Utilities Association — General meeting, Hotel Pere Marquette, Peoria, Ill., November 14-15. Jack Abbey, secretary, 935 Illinois Bldg., Springfield, Ill.

American Society of Mechanical Engineers—Annual meeting, New York, N. Y., December 2-5. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

American Society of Agricultural Engineers—Fall meeting, Chicago, Ill., December 2-6.

National Exposition of Power and Mechanical Engineering—Grand Central Palace, New York, N. Y., December 2-7.

National Association of Railroad and Utilities Commissioners—Annual convention, Hotel Miami-Biltmore, Miami, Fla., December 10-12. Clyde S. Bailey, secretary, New Post Office Bldg., Washington, D. C.

National Chemical Exposition — Sponsored by Chicago Section, American Chemical Society, Stevens Hotel, Chicago, December 11-15.

Washington Airport Contracts with V.P.S.

Electric power for the Washington Airport, now under construction at Gravelly Point, is to be supplied by the Virginia Public Service Co., according to a contract recently signed by airport authorities and the power company, it was announced Monday by J. W. Howard, northern division manager.

To render this service it will be necessary for the company to begin immediately a $50,000 construction program, Mr. Howard said.

The construction will involve the installation of duplicate equipment at the substation now serving the airport. When connected, one circuit will feed from the V.P.S. Clarendon 22-kv. line and the other from the Naval Radio 22-kv. circuit. The two circuits will then connect to two separate three-phase transformers, so that if anything happens to one circuit or transformer the other circuit will automatically take care of the load. Both circuits and both transformers will be in service at all times.

The equipment itself will be protected by the proper relaying equipment to assure automatic operation should trouble develop at any time.

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Federal Jury Discharged

The federal grand jury investigation of utility operations in the Milwaukee area has been dropped or deferred until a new term of court, it was learned on September 26, when the grand jury that has been on call since last January made its final report to Federal Judge F. Ryan Duffy at Milwaukee and was discharged.

•

Co-operatives Exempted from Paying Sales Tax

Members of rural electrification co-operatives are not liable for the state sales tax on electric power bills in Arkansas, Judge Frank Dodge ruled in Pulaski Chancery Court, Little Rock, recently, in granting a petition of the Ozark Rural Electric Co-operative Co. for an injunction to prevent Arkansas Revenue Commissioner Z. M. McCarroll from collecting the tax on its sales to consumers.

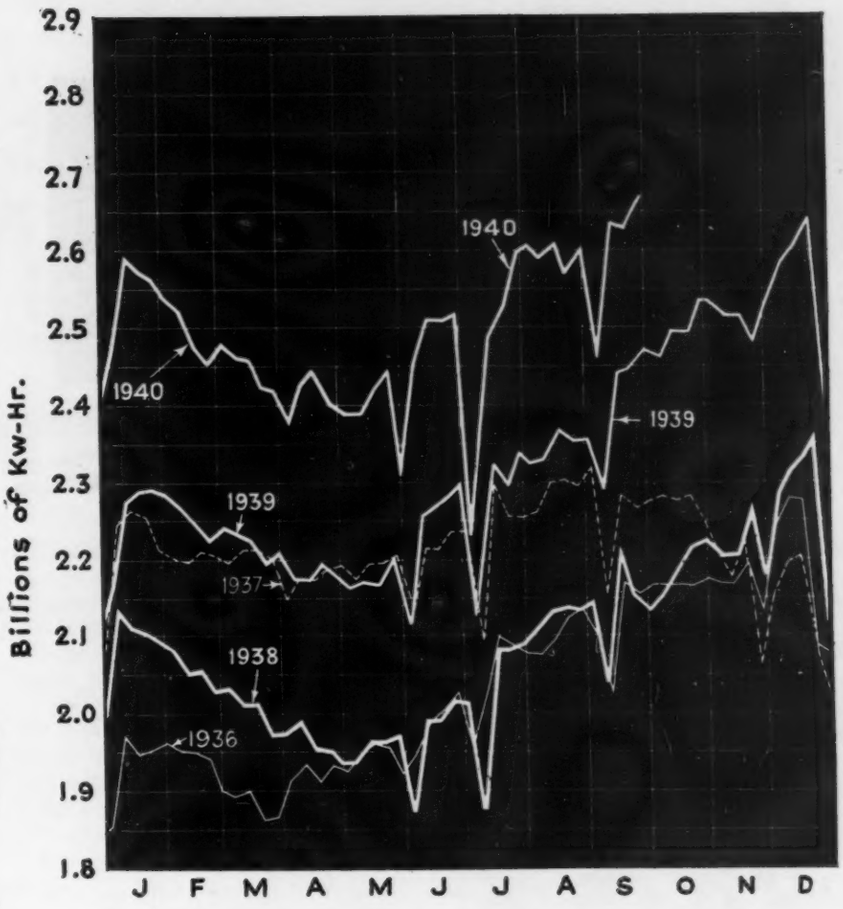
The plaintiff contended that Act 342 of 1937 exempted electric co-operatives from payment of the sales tax. Chancellor Dodge dismissed a demurrer filed by lawyers for the revenue commissioner. The decision will be appealed to the state Supreme Court.

Energy Production Sets New Record

Production of electricity by the electric light and power industry reached a new all-time high in the week ended September 28. Output amounted to 2,669,661,000 kw.-hr., according to the Edison Electric Institute, a gain of 8.1 per cent over the corresponding week of last year, of 24.9 per cent over 1938 and of 17.3 per cent over 1937.

The energy production in the most recent week was a gain of 1.1 per cent over the previous record output of 2,641,458,000 kw.-hr. during the week ended December 23, 1939. A year ago the corresponding gain over the previous winter peak was 4.5 per cent; in 1938, the corresponding week's output represented a 2.9 per cent decrease.

Among the major geographic regions, the Central Industrial region remains in the lead in point of percentage gain over 1939. West Central, Southern and Pacific areas widened their margins over 1939 in the most recent week, while both New England and the Rocky Mountain regions dropped to their lowest margins for the year. The Rocky Mountain states have dropped from 32.6 per cent in the week ended July 6 to 2.9 per cent in the week ended September 28.



Weekly Output, Millions Kw.Hr.

1940		1939		1937	
Sept. 28	2,670	Sept. 30	2,470	Oct. 2	2,276
Sept. 21	2,629	Sept. 23	2,449	Sept. 25	2,266
Sept. 14	2,639	Sept. 16	2,444	Sept. 18	2,281
Sept. 7	2,463	Sept. 9	2,290	Sept. 11	2,154
Aug. 31	2,601	Sept. 2	2,357	Sept. 4	2,321
Aug. 24	2,571	Aug. 26	2,355	Aug. 28	2,295
Aug. 17	2,606	Aug. 19	2,368	Aug. 21	2,304

Per Cent Change from Previous Year

	Week Ending		
	Sept. 28	Sept. 21	Sept. 14
New England	+ 1.1	+ 4.5	+ 6.1
Middle Atlantic	+ 5.6	+ 7.6	+ 7.9
Central Industrial	+11.0	+11.9	+11.8
West Central	+ 9.0	+ 4.6	+ 2.7
Southern States	+ 7.7	+ 3.2	+ 2.9
Rocky Mountain	+ 2.9	+ 3.9	+ 9.4
Pacific	+ 7.7	+ 2.8	+ 6.1
United States	+ 8.1	+ 7.3	+ 7.9

AFL Unit Wins Run-Off Election at Consumers

In a run-off election held at Consumers Power Co., Jackson, Mich., returns not as yet certified show 1,399 votes cast for International Brotherhood of Electrical Workers (AFL) and 1,363 votes cast for Utility Workers Organizing Committee (CIO). A previous poll, held August 13-16, 1940, showed 1,020 and 1,302 votes respectively.

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Bonneville Output Takes Sharp Rise in August

Energy generated by the Bonneville Administration rose to 55,911,700 kw.-hr. in August from 36,739,000 kw.-hr. in July. Bonneville sales at wholesale amounted to 37,489,220 kw.-hr., with revenues of $86,031, or a wholesale rate of 2.29 mills per kw.-hr. Load factor on the system was 82.6 per cent in August, as against 78.4 in July. Maximum demand was 91,000 kw. for August, as against 63,000 kw. for July.

August was the first month that the interchange agreement with Washington Water Power was in effect; net delivery to Washington Water Power amounted to 14,560,000 kw.-hr.; this figure added to the wholesale sales makes a total of 52,049,220 kw.-hr.

•

August Output Gains 10% Over Year Ago

Production of electric energy for public use in the twelve months ended August 31 totaled 137,923,000,000 kw.-hr., a gain of 12 per cent over the previous year, according to the Federal Power Commission.

Energy output during August amounted to 12,202,371,000 kw.-hr., or 10.4 per cent more than in August, 1939. Daily production during August was 2.9 per cent above that during July. Production by water power accounted for 32 per cent of the total output during August, as compared with 35 per cent in July and 32 per cent in August of last year.

Reports received during September indicate that the capacity of generating plants in service on August 31 totaled 41,056,000 kw., a net increase of 134,000 kw. over that previously reported.

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Canadian Output Advances

Output of central electric stations in Canada in July totaled 2,615,232,000 kw.-hr., against 2,578,883,000 kw.-hr. in June and 2,205,844,000 kw.-hr. in July last year. The figure was the highest on record and the month's percentage gain over the previous year at 18.5 was the widest expansion this year.

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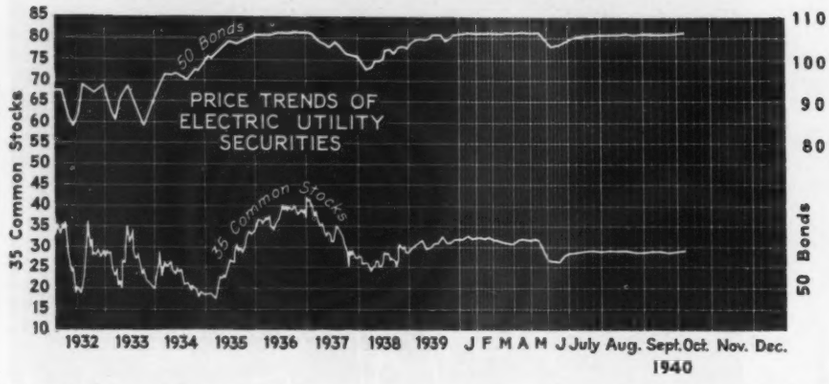
PUD Reduces Rates

Pacific County, Washington, electric power rates have been cut by the Public Utility District Commissioners at Raymond, Wash., in amounts ranging from 21 per cent for residential customers to 44 per cent for municipal users, effective October 1.

Stocks Slightly Lower; Bonds Firm


PRICE TRENDS OF
ELECTRIC UTILITY
SECURITIES
50 Bonds
35 Common Stocks
35 Common Stocks
50 Bonds
1932 1933 1934 1935 1936 1937 1938 1939 J F M A M J July Aug. Sept. Oct. Nov. Dec.
1940

Electric light and power stocks turned downward during the past week, the "Electrical World" index dipping to 28.9 from 29.0 the preceding week; last year, 30.0. Bonds held firm at 106.0, unchanged from last week; last year, 104.3

Schenker to Head SEC Investment Division

Securities and Exchange Commission announced the formation of the Investment Company Division to carry out the duties of the commission under the recently enacted Investment Company Act of 1940 and Investment Advisers Act of 1940.

David Schenker has been appointed director of the new division. John H. Hollands will be assistant director. For the past several years Mr. Schenker has been counsel to the Investment Trust Study. This study resulted in the enactment of the new statute providing for the registration and regulation of investment companies and investment advisers.

Mr. Schenker has been associated with the commission since its inception, prior to which time he was associate counsel to the Senate banking and currency committee to investigate stock exchange practices.

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Hygrade Sylvania Files Preferred and Common

Hygrade Sylvania Corp., Salem, Mass., has filed with the SEC a registration statement for 85,000 shares of 4½ per cent cumulative convertible preferred stock, $40 par, and 85,000 shares of no-par common.

The company will offer 52,317.5 shares of preferred to holders of $6.50 convertible preferred on the basis of 2½ shares for each share held. New preferred shares not exchanged will be offered to the public at a price to be named. All common stock registered is reserved against exercise of conversion rights of preferred-stock holders.

Proceeds from new preferred not exchanged will be used to redeem for cash any of the $6.50 preferred not offered in exchange. The company stated it deemed it advisable to increase its working capital in view of developments in manufacture and sale of radio tubes and the products in the fluorescent lighting field and the possibility of the acquisition of a glass manufacturing plant.

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Michigan Utility Plans to Issue Securities

Michigan Public Service Co. has filed with the SEC a registration statement covering the issuance of $3,500,000 of first mortgage 4 per cent bonds due in 1965, $750,000 of serial debentures due from 1941 to 1950, 7,321 shares of 6 per cent preferred stock, $100 par, and 85,000 shares of no-par common stock.

Proceeds from the sale of the bonds and debentures are to be used by the company to redeem its $3,943,000 of first mortgage 5 per cent bonds due in 1947 and for working capital. The preferred stock registered will be offered in exchange for outstanding 6 and 7 per cent preferred stock of the company.

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Los Angeles Plans Power Financing

Department of Water and Power of Los Angeles, Calif., has announced that it will be in the market about October 22 with an issue of electric revenue refunding bonds aggregating $42,592,000. The financing will consist of $24,910,000 of term bonds and $17,682,000 of serials.

Proceeds from the sale of these issues will be used to refund $11,915,000 of series A, 1937 bonds, due from 1961 to 1977; $23,500,000 of series B, 1937, and $5,390,000 of second issue of 1937, due from 1959 to 1977.

The new refunding bonds will be dated October 1, 1940. The serials will mature from 1941 to 1976 and the term bonds will fall due on October 1, 1976.

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Engineers System Plans to Simplify

Engineers Public Service Co. is considering a plan for the simplification of the corporate structure of its system through liquidation of a sub-holding company, El Paso Electric Co. (Del.), and the liquidation of an operating subsidiary, Mesilla Valley Electric Co., after transfer of its ownership to El Paso Electric Co. (Tex.).

The plan, according to D. C. Barnes, president of Engineers Public Service, is conditioned on refinancing El Paso Electric Co. (Tex.) through the sale of $6,500,000 first mortgage bonds, $1,000,000 of unsecured debt and 24,000 shares of a new issue of preferred stock. If such a sale is effected, that company will redeem its $8,000,000 first mortgage 5s now outstanding at 102 and accrued interest and its 7,785 shares of $6 preferred at 110 and accrued dividends.

Following that operation it is planned to liquidate the sub-holding company, El Paso Electric (Del.), in which event the 25,988 shares of its $7 dividend and the 176 shares of $6 dividend preferred stock would receive $100 per share and accrued dividends in liquidation.

The parent Engineers Public Service would supply the cash for the liquidation of the Delaware company's preferred through the purchase of additional common shares of the Delaware company. After that concern's liquidation its assets would go directly to control of Engineers.

Utility Reports

	Net Income 1940	1939
*Arkansas Power & Light..	$1,156,119	$1,405,143
*Commonwealth & Southern and subs.	13,639,047	13,034,924
*Dallas Power & Light.....	1,803,311	1,604,746
*Florida Power & Light....	2,332,719	1,545,301
*Houston Lighting & Power	2,882,117	2,853,802
*Louisiana Power & Light..	1,061,491	1,048,517
*Louisville Gas & Electric (Ky.) and subs.	3,050,543	2,685,318
*Minnesota Power & Light.	1,418,097	1,268,076
*Montana Power and subs.	4,168,249	2,991,908
*Nebraska Power	1,658,768	1,882,627
*New Orleans Public Service	2,687,528	1,763,354
*Texas Electric Service.....	1,555,576	1,161,851
*Texas Power & Light.....	2,051,024	1,131,090
*Utah Power & Light and subs.	1,774,157	1,639,443

*Twelve months ended August 31.

OPERATING PRACTICES

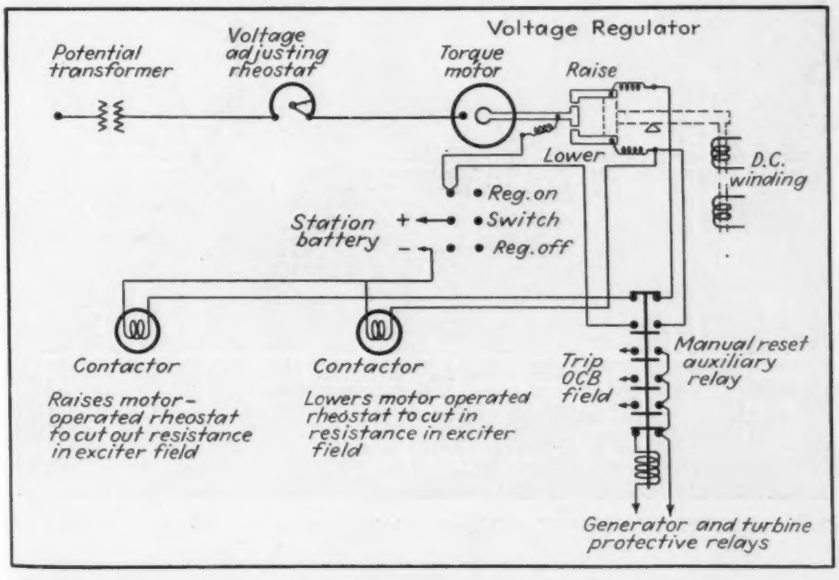
Generator Relays Protect Exciter

By G. I. SMITH
Switchboard Operator
Minnesota Power & Light Company, Duluth

Differential protective relaying for a.c. generators usually provides for the opening of the field switch to remove the excitation and prevent power from being fed to faults in the generator windings, after the generator has tripped off the line.

An alternator having its individual exciter and voltage regulator will provide the a.c. source for the voltage regulator from its own potential transformer, rather than from a bus potential transformer as is the case when an exciter and voltage regulator supplies the field for more than one unit. When the generator trips off the line and the field switch opens the a.c. element of the voltage regulator indicates low voltage to the controls and the regulator will raise the exciter voltage to its maximum, which might prove dangerous to the armature and commutator. Use of an auxiliary relay, or contacts in the relay which trips the generator switches, would reverse the action of the regulator, lowering the exciter voltage instead of raising it.

This arrangement has been used successfully on a steam turbo-generator unit having a direct-connected exciter with a pilot exciter and a voltage regulator which controls a motor-operated Wheatstone bridge rheostat. All generator and turbine protective relays trip a manual reset multi-contact auxiliary relay, which in turn closes the trip circuits for the generator oil circuit breakers and field switches. Two contacts in this relay—one circuit opening and one circuit closing—are used in the rheostat control circuits of the voltage regulator. When this relay is tripped the contacts open the "raise" circuit and close the "lower" circuit to run the rheostat down to its limit switch, reducing the exciter voltage to zero.



GENERATOR auxiliary relay lowers exciter voltage when generator trips off the line

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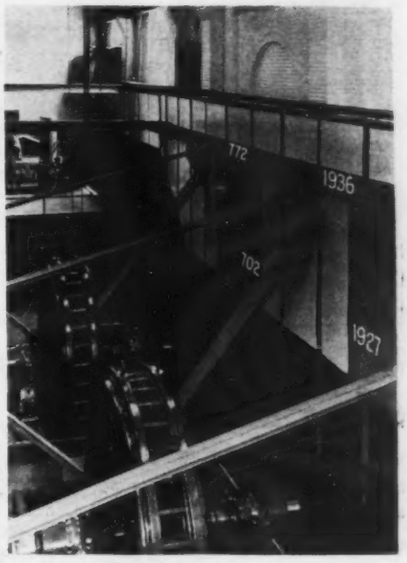
Floodproofing a Generator Pit



RIVERSIDE WALL built above previous flood levels and braced against future inundations

A New England hydro-electric station which suffered from flooding of its generator pit in the 1927 and 1936 inundations has greatly improved its protection against future high water by erecting a concrete panel wall on the river side of the operating room, blanking off all window openings and raising the solid barrier to a level well above the previous maximum river stage.

The barrier wall has been built against the main brick wall of the

station and this is supported against future lateral pressure by double angle struts of steel which buttress the inner wall and transmit pressures to suitable anchorages within the station. Space for handling generator and waterwheel parts by crane remains between the diagonal bracing shown.

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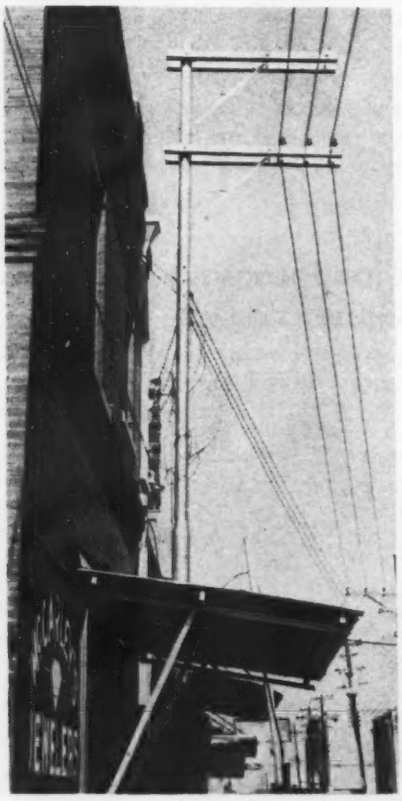
Lengthened Pole Clears Building Construction



CONSTRUCTION BYPASS for high-tension lines is provided by lengthening ordinary service pole and bracketing crossarms

When construction of a new building on the side of a narrow street formerly used for a high-tension distribution line made a temporary shift in the line necessary the Southwestern Gas & Electric Company effected the change in its lines with no disturbance at sidewalk level. The original short service pole, carrying its wires at second-story level, was lengthened by welding in a section of pipe to carry the top above the roof level. Arms, bracketed from the pole at this height, serve to carry the high-tension line at a level and with clearance ample to prevent possible fouling by any construction equipment.

Former distribution service is carried on the extended pole on brackets bolted on at their former level.

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Co-ordinated Space in Distribution Building

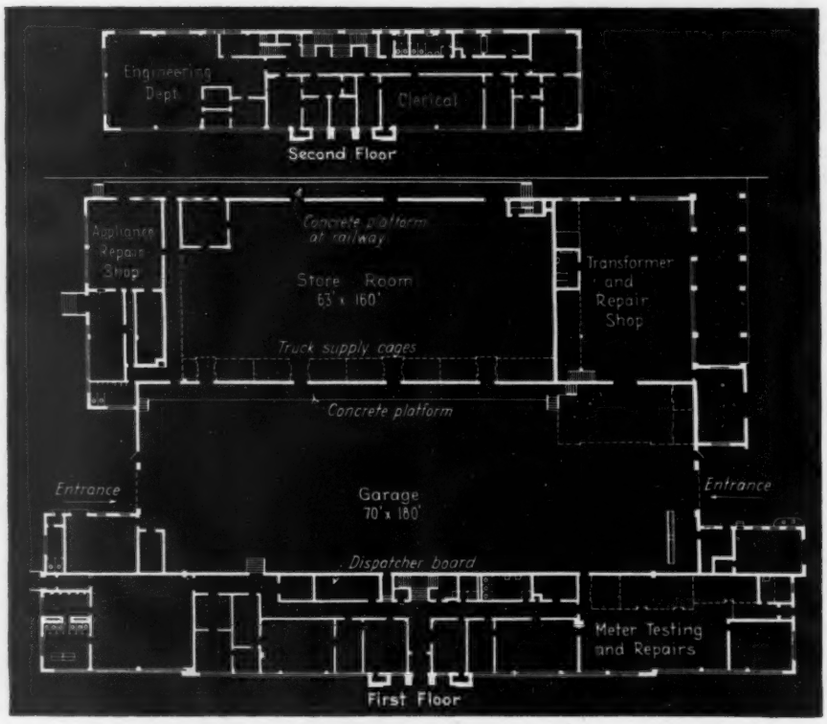
By S. R. FINLEY
General Superintendent Electric Power Board of Chattanooga, Chattanooga, Tenn.

Economies of operation resulting from co-ordination of all departments under one roof in the new distribution building of the Electric Power Board of Chattanooga are expected to provide savings of approximately $20,000 a year over the routine now in force.

At present, trucks are stored in one place, meter stores are at another place, line department operations at another, engineering department at another and substation and underground maintenance at still another place. The new building will house the meter department, appliance and transformer repair shops, maintenance materials storerooms, auto and truck storage facilities and the engineering department. New operating routine that will make for a minimum of waiting time during the day includes servicing of all automotive equipment, and loading and checking of materials for construction trucks at night.

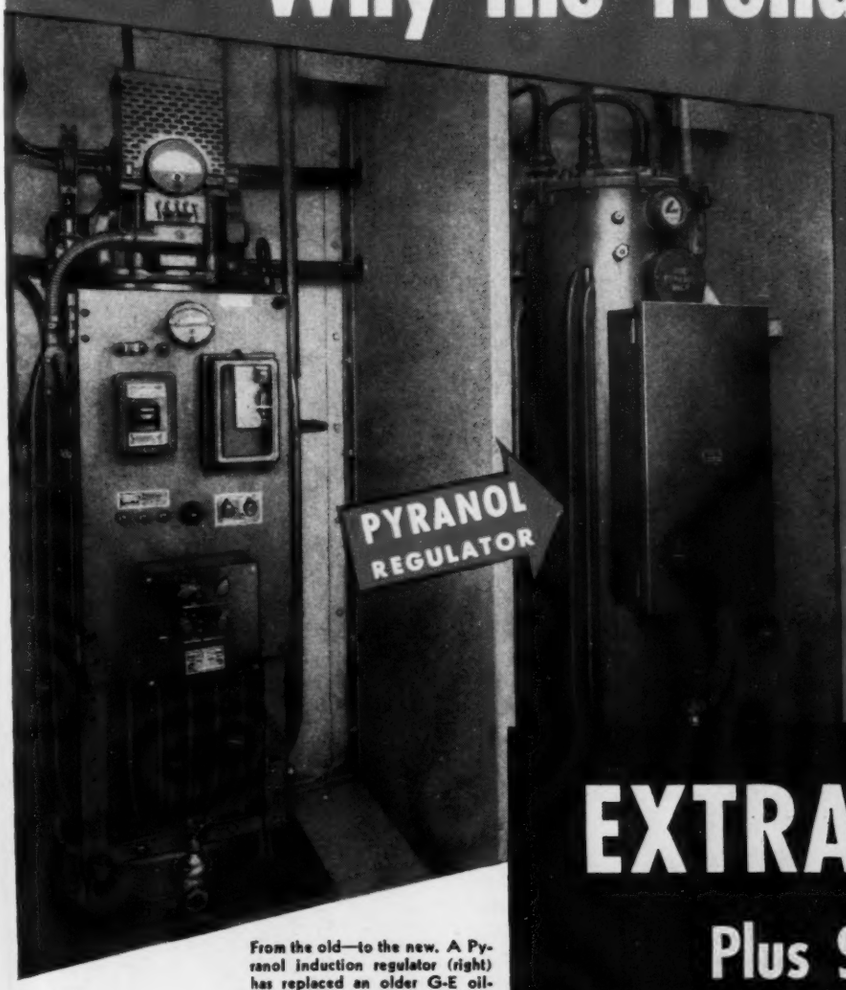
At the right of the main entrance to the building is an information station. The rest of the right wing of the first floor section is given over to the meter department. Here space for meter records, testing and repairs, laboratory and storage has been so arranged as to provide for a logical flow of work. The left wing of the first floor is occupied by the superintendent of operations, trouble dispatchers, trouble shooters, employees' lockers and showers. An emergency supply room and dry room for hot-line tools open on both the inside and outside parking areas for trouble shooters' cars. Across the corridor from the superintendent of operation's office is the system dispatching board.

Drive-in entrances to the garage storage area are at opposite ends of the building. Maintenance materials storeroom of 63 x 160 ft. has inside and outside concrete platforms for loading trucks, the outside platform adjoining a railroad siding. Truck supply cages, in which materials for extensive jobs may be stored until



NEW DISTRIBUTION BUILDING will house all departments in building 320 ft. long by 190 ft. deep. Meter department, transformer and appliance repair shops, maintenance materials storeroom, auto and truck storage and engineering department will be co-ordinated, with resultant economies of operation

Why the Trend to PYRANOL REGULATORS FOR FEEDER-VOLTAGE CONTROL ?



From the old—to the new. A Pyranol induction regulator (right) has replaced an older G-E oil-filled unit. Part of a modernization program of a large midwestern utility—part of the trend to Pyranol.

EXTRA SAFETY

Plus Savings in Installation Costs

OPERATORS have been quick to recognize the many advantages of the new Pyranol induction regulator. For the first time, they can obtain the safety and economy of Pyranol* in a regulator. Because it is of the *induction* type, this regulator also has the advantage of inherent simplicity of design.

Pyranol can't burn, so these regulators can be installed indoors without the costly cell construction normally used to isolate oil-filled equipment. Both installation costs and space requirements are minimized.

Get complete information on Pyranol regulators from our local representative, or write for Bulletin GEA-3443. General Electric, Schenectady, N. Y.

*Pyranol is General Electric's noninflammable, nonsludging insulating and cooling liquid for electric equipment.

GENERAL ELECTRIC

204-11

the job is completed, feature the materials storeroom; these cages are accessible only to the individual truck foremen.

The appliance repair shop is convenient to customers and contractors who call on the board for appliance repair parts. Transformer repair shop has outside storage space. Second floor of the front portion of the building will be occupied by the engineering department, purchasing department, superintendent of distribution, clerks and material estimators.

R. H. Hunt Company was the architect; construction cost of the building alone is $250,000, with the site and equipment adding $50,000. The building is being constructed as a PWA project.

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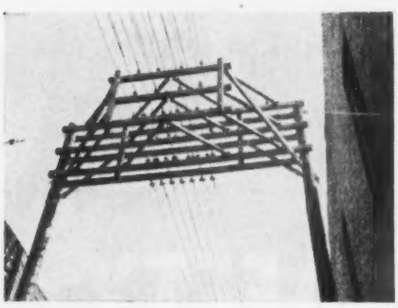
Alley Structure



One of four blind dead-end alley structures recently installed in the downtown section of Tulsa by the Public Service Company of Oklahoma. Made up of 4x7-in. wood braces, the structure supports fifteen conductors. The two top circuits are 4,000 volts, three-phase, four-wire. Maximum tension per No. 2/0 conductor in these two circuits is about 1,500 lb. On the lower arm are two two-phase and one three-phase secondary circuits. This is a Hughes Brothers structure.

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Metering for Two-Rate Two-Way Power

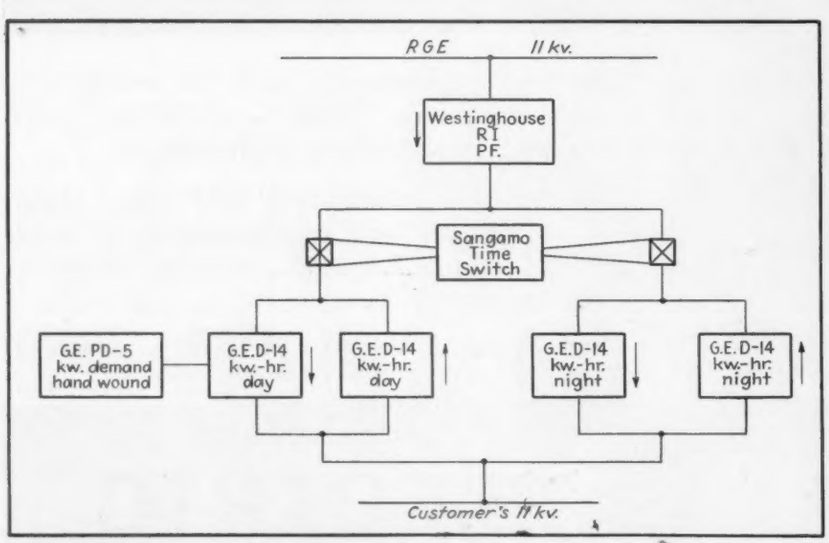
By H. G. BROWN
Assistant Superintendent of Meters
Rochester Gas & Electric Corporation

Contractual arrangements with one of the corporation's larger customers on the power supply and interchange were such as to call for a special arrangement for metering. Two sets of two-rate meters were installed with ratchets to prevent reverse registration when power flows from the customer's 11-kv. plant bus and from the R.G.&E. 11-kv. supply. The night rate in each case differs from the day rate and consequently two meters were provided for each direction of power flow, along with a time switch to shift at the proper time to the proper pair of meters. In addition, a demand charge applies for daytime input to the customer's system.

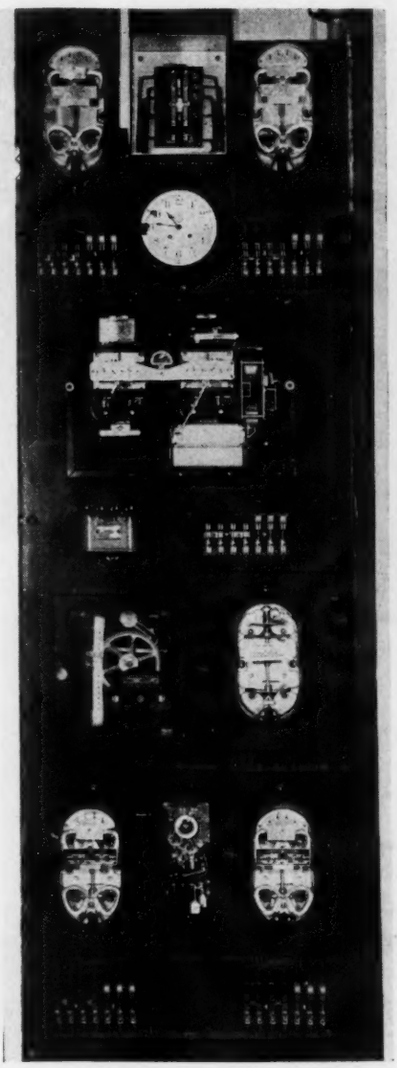
The time switch is an electrically wound Sangamo VSW device with 48-hour carryover and means for making the respective meters function on the night rate on Sundays and holidays. The switch opens the meter potentials and current is on the meter at all times of load; an anti-creep detent is provided on all four watt-hour meters to prevent creep on current alone. The time switch is electrically interlocked with the demand meter so that meter potentials will be switched at the end of a 30-minute demand interval.

The supply is designed for 4,000 kw. capacity and has 100/1 voltage transformers and 50/1 current transformers.

In addition to the above requirements the rate carries a power-factor clause and a RI reactive and kva. meter was installed to provide data for this element of the billing for input energy.

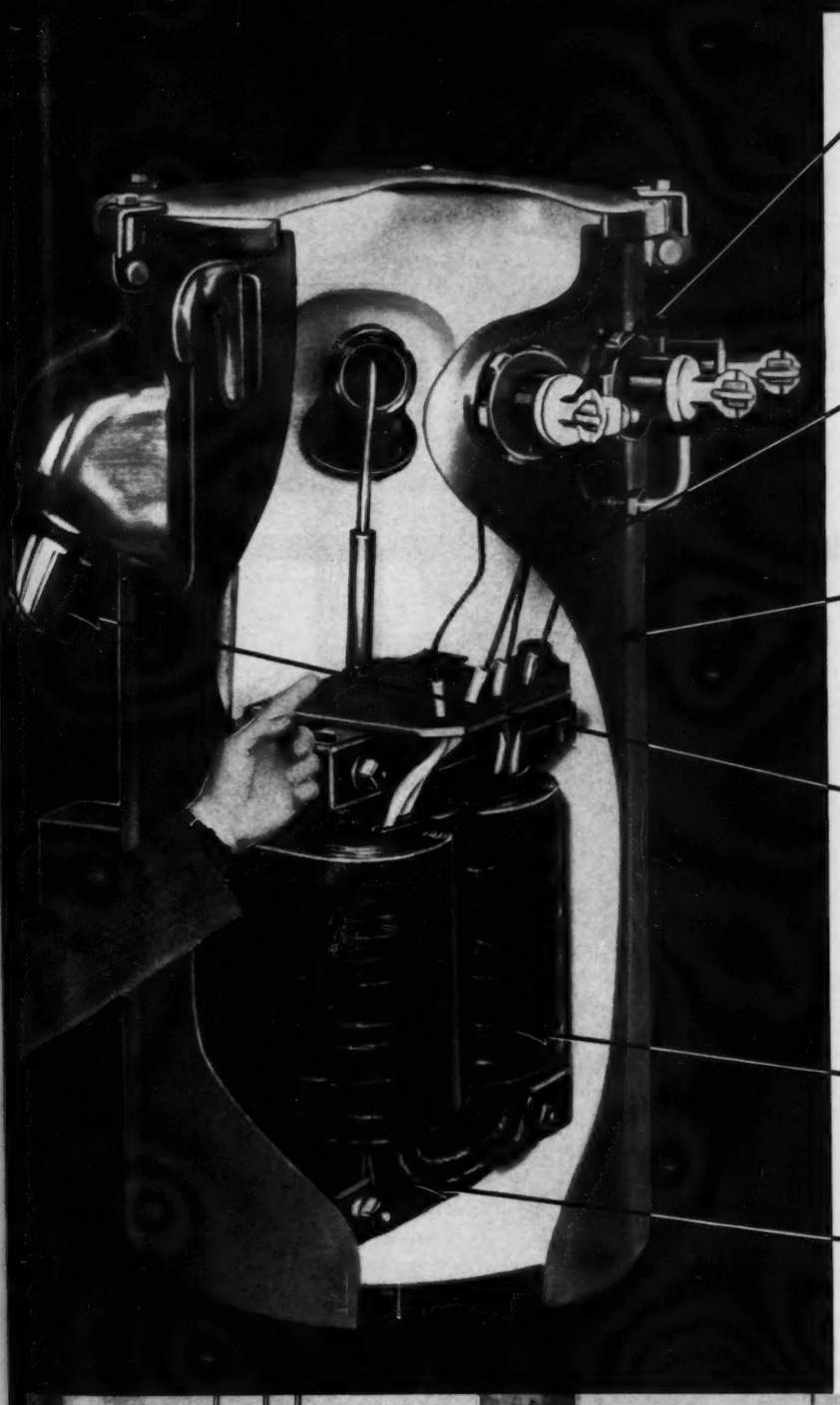


TWO-WAY METERING provides for two-rate interchange



ALL interchange metering on single panel

The panel is 28x80 in. The RI meter just above the middle is controlled by a power-directional relay (below it to the right) adapted from a watt-hour meter, shown minus a register. This prevents registration when the power factor is leading or when the customer's plant is feeding into the R.G.&E. system. Some instruments are shown with cover removed.



1. Revolutionary Cadmium-plated 3-Way Terminal Cuts Installation Time . . . Simplifies Wiring Job . . . Minimizes Electrolytic Action on Copper or Aluminum Conductors.

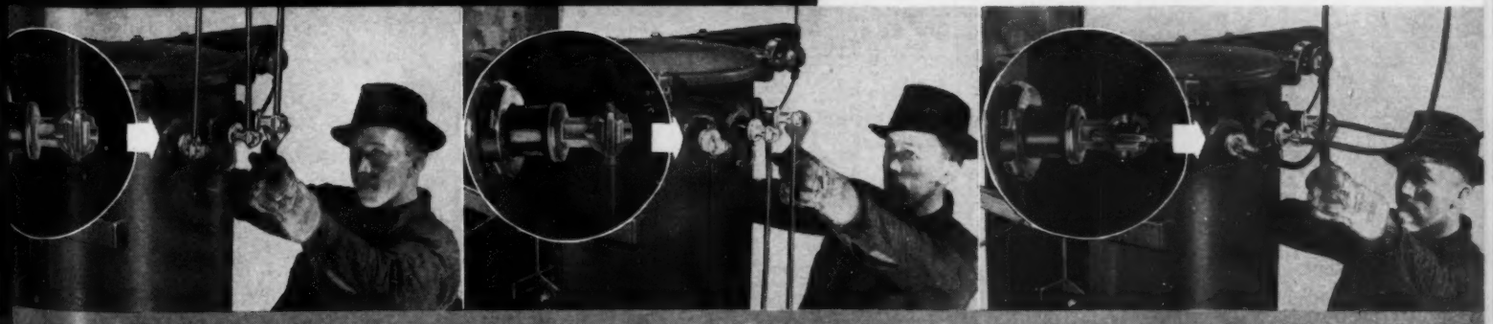
2. New, Durable Steel Tank, Tested Under Pressure . . . Prevents Oil Leakage . . . Assures Long Life.

3. New Spra-bonderizing . . . Plus Triple Coat Automobile Finish . . . Gives Positive 4-Way Rust Protection.

4. Extra-heavy Porcelain Coordinated Bushings with Liberal Creepage . . . Offer Maximum Reliability Under Fog, Dust, Chemical, or Other Adverse Operating Conditions.

5. Double Conductor Insulation Provides Double Safety Against Winding Failures.

6. Time-proven Core and Coil Construction . . . Designed for Years of Efficient, Service-free Operation.



SEE HOW THE NEW 3-WAY TERMINAL WORKS! First and second pictures show how simply and easily leads can be brought to the transformer from both top and bottom. But you don't stop there! For the third picture illustrates an ***extra*** advantage you get with no other terminal! If necessary, leads can be brought straight out from the transformer, without making an extra bend in the conductors or complicating the wiring job. Notice how the tightening tool travels in an ***up and down*** direction eliminating the chance for accidental shorts across the secondary terminals. Notice, too, that a standard lineman's wrench is used. No special tools are needed. You don't have to buy extra fittings. Heavy cadmium plating of the 3-Way Terminal makes it possible to be used with ***both*** copper and aluminum conductors with a minimum of electrolytic action.

TRANSFORMERS *Cut Operating Costs*

INDUSTRIAL ENGINEERING

Pump Motor Control at Unattended Station

By A. P. SCHNYDER
Electrical Engineer for George F. Hardy, Consulting Engineer, New York, N. Y.

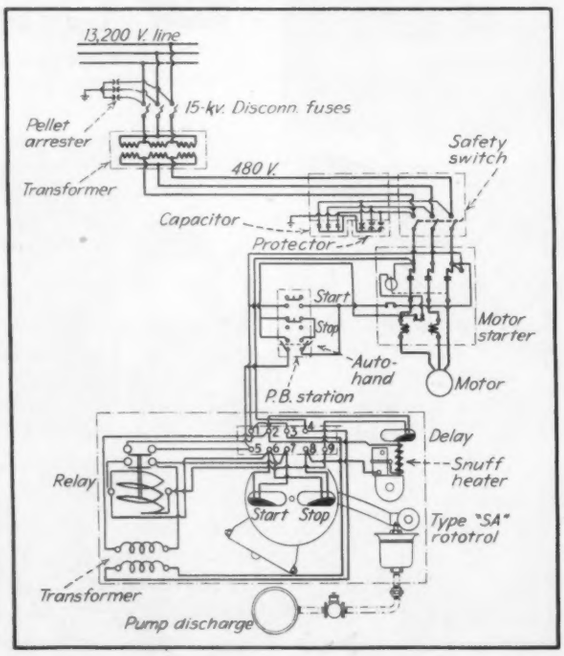
The 200-hp. deep-well pump motors at the artesian wells supplying the newsprint mill at Lufkin, Tex. (ELECTRICAL WORLD, August 10, 1940, page 56), are started at full voltage.

The magnetically operated across-the-line contactor is controlled by a start-stop push button which includes a selective transfer device whereby an automatic control ("Rototrol") responsive to hydrostatic water line pressure can be substituted for manual push-button operation.

Features of the latter device consist of a pressure diaphragm connected to a pipe line on the discharge side of valves in individual pump discharge, pivoted operating lever, adjustably weighted rotating disk, "start-stop" Mercoid switches mounted on the latter and, finally, a "delay" Mercoid switch fastened horizontally to an upright metallic strip which will deflect under heat from surrounding coil. The function is to stop the motor at a predetermined higher water line pressure and restart it at any desired lower pressure. The "delay" prevents hunting by introducing a few seconds delay to the "stopping" operation and some five minutes—the time necessary for cooling of heater strip—before re-"starting."

The delayed restarting permits the pump to come to rest after stop and subsequent reversal of rotation due to reverse flow of water in pipe riser. A check valve prevents reverse flow from pipe line. The selector switch at the push button permits operating the wells manually or automatically and to rotate them at will for automatic operation.

Similar pressure controls had proved positive and reliable on another installation in service for the last three years.



CONTROL at unattended water well pumping station for 200-hp. hollow-shaft vertical motors started at full voltage

Preventing Electrical Fires in Factories

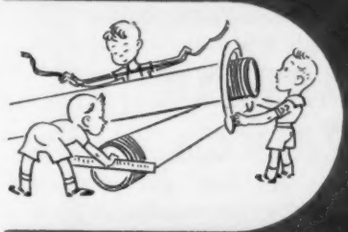
Analyses of fire causes in three plants covered by the Associated Factory Mutual group offer suggestive lessons to electrical engineers in industry. In Case 1 welders cut a steel wall plate away so that electricians could install wiring in a long vertical pipe shaft. Watchmen with extinguishers were commendably placed on duty, but the tile wall behind the plate contained cracks not filled with mortar and sparks entered the pipe shaft, igniting lint and pipe covering. Two hours later smoke was seen coming from the shaft, and after venting the shaft from the top to the outside the fire was put out with a damage of $700 to communication lines and pipe covering. Future safeguards provided for extra care against the passage of sparks through openings leading to possibly inflammable areas.

Lightning Surge

In Case 2 a lightning surge entered an industrial substation in spite of an arrester installation at the transformers, damaging an oil circuit breaker and producing sparks which ignited a large pile of broke near the switchboard. The operation of sprinklers and extinguishers confined the damage to $700 in switchboard equipment and process material. Complete separation of switchboards from combustible material was the lesson here. The third case emphasized the vital importance of using elevator power and control cables of the fireproof type or with flame-retardant outer covering. The installation suffered the breakage of a steel

FOR ENDURING SERVICE USE G-E WHITE QUALITY CONDUIT

G-E White Is Permanent



G-E White Is Uniform

G-E White Is Resistant to Flame and Heat

G-E White Is Resistant to Gas, Acid, Moisture

G-E White Is Resistant to Mechanical Injury

The high quality of G-E White Rigid Conduit makes it resistant to injuries of all sorts and gives it a long, dependable life. G-E White will protect wiring systems indefinitely.

Mild, "rimmed steel," an open-hearth product, is used which provides strong welds, and makes the conduit easy bending and clean threading.

Hot-dipped galvanizing and Glyptal coating inside and out provide lasting protection against heat, flame, acids, alkalies, moisture, etc.

All during the manufacturing process rigid specifications are followed closely. Only the finest of raw materials are used.

Here, indeed, is a conduit worthy of being installed where service conditions are toughest. A complete line of boxes and fittings are available.

For further information see the nearest G-E Merchandise Distributor or write to Section C-0130, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

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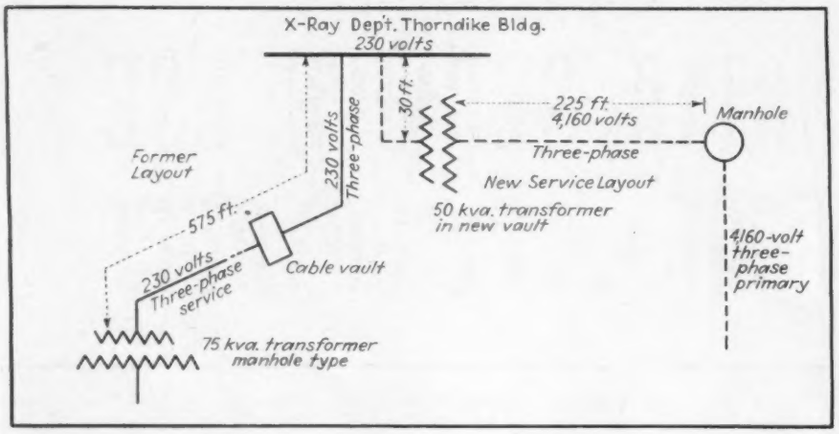

THIRTY-FOOT SERVICE will replace 575-ft. run to provide better voltage regulation in hospital department

strand carrying the weight of the cables suspended from the car bottom and from a midway junction box. This caused a short circuit and arc which ignited combustible insulation, fire spreading to all cables and endangering passengers.

•

Infra-Red Heat for Gluing

To preheat the edges of wood stock that are to be glued together into "flats" the Stattin Brothers Furniture Company, Chicago, customarily used steam coils. This was an expensive and inconvenient procedure, particularly during the summer months, when boiler operation is not ordinarily required. As a substitute the company tried infra-red heating and found it most suitable for this heating operation. The installation that is being used is shown in the accompanying illustration.

The wood is heated under a lamp bank consisting essentially of two parallel rows of thirteen 260-watt, 110-volt carbon filament lamps in $8\frac{1}{4}$-in. diameter Alzak reflectors. The 110-volt lamps are connected two in series across 220 volts. For flexibility each of the two rows of lamps is arranged for separate switching.

Reflectors of each row are mounted on standard wiring channel 9 ft. 4 in. long with reflectors rim to rim. The two rows of lamps are $10\frac{1}{2}$ in. apart and are suspended from the ceiling by 1 x $\frac{1}{8}$-in. perforated metal straps which offer a convenient method of height adjustment.

Wood stock that is to be warmed is placed on edge on a skeleton bench, the surface of which is about 12 in. below the lamp. Since the width of the wood varies over a wide range the distance from lamp to wood has no particular significance. The wood remains under the lamps from two to three minutes, or until the surface is judged to be warm enough by the operator.

TWENTY-SIX 260-watt infra-red lamps in 8¼-in. Alzak reflectors replace steam coils for preheating wood prior to gluing

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Improve X-Ray Supply Regulation

Hospitals operating X-ray apparatus will be interested in the recent solution of a voltage regulating problem at the Thorndike Memorial Building of the Boston City Hospital. In this large group of buildings the distances involved in providing electric service from a central point are considerable. In the X-ray department service has been provided for some time by a 230-volt, three-phase underground circuit about 575 ft. long running from a Boston Edison 75-kva. manhole type transformer on an adjoining street through a cable vault to the switchboard of the department.

Although the conductors were of 500,000-circ.mil size, the potential drop on the service reached 4 to 6 volts at the Thorndike Building end. This was undesirable from two standpoints: (1) Unsatisfactory voltage fluctuations in the administering of X-ray treatments, say of the order of 5,200 volts in a 200-kv. outfit, and (2) occasional tube burnouts, costing around $500 each, apart from the inconvenience of interrupted service to patients.

Engineering investigation of the conditions led the trustees to approve the installation of a new supply, the old service being retained for convenience in meeting future requirements. In the new layout a connection is provided from an Edison manhole on another street 225 ft. from a new vault being built to serve Thorndike, by a 4,160-volt primary terminating at a 50-kva. transformer delivering 220-volt, three-phase service over a 30-ft. run to the user's switchboard. This service is partly 350,000 circ.-mil and partly 500,000 circ.-mil and is designed to eliminate trouble from voltage drop with nine X-ray outfits and two X-ray treatment units in the department. The treatment outfits may run from eight to twenty minutes at a stretch and minimum voltage fluctuations are necessary to insure proper results with patients.

REVERE TECHNICAL ADVISORY SERVICE

In many plants and industries, Revere Technical Advisory Service men are working shoulder to shoulder with executives and engineers in solving defense problems by selecting a suitable type and form of copper or one of the many copper base alloys.

These are picked men, with broad backgrounds in metal-working methods, plus highly specialized knowledge of copper and copper base alloy characteristics and applications. They are supported in this work by the full cooperation of the Revere Research Laboratories and Revere Mills.

This Technical Advisory Service comprises a thoroughly equipped Research Laboratory, manned by engineers and metallurgists for (1) developing new and better Revere materials to meet active or anticipated needs of industry; (2) supplying specific and detailed knowledge of the properties of engineering and construction materials; and (3) continuously observing developments of science and engineering with a view to their utilization in the improvement of Revere production methods and equipment.

In addition a corps of technical men are available to (1) help industrial executives make use of data developed by the Revere research laboratory staff; (2) perceive the material problems existent in industrial plants contacted; (3) assemble data enabling Revere research laboratory men to study these problems; and (4) make practical tests of the materials recommended in the plants concerned.

This Revere Technical Advisory Service set-up has been very successful in reducing costs, improving products and increasing the output for many industrial concerns.

Its service is available to you with no expense or obligation on your part.

Behind the wheels of industry, as it mobilizes for the defense program, there must be dependable power.

Already the power industry itself has been forced to order equipment much earlier than planned.

Revere Copper and Brass Incorporated is prepared for power orders for tubes, condenser plates, bus bar, pipe, tubing and Herculoy—Revere's patented silicon bronze, which is extensively used in pole line hardware and in tanks.

In the past ten years, Revere research, coupled with Revere plant expansion, has put this company in the position of being able to give speedy service on orders for copper, bronze, brass and other copper alloys. We invite you to consult the Revere Technical Advisory Service for assistance in speeding up your output, minimizing your cost and increasing your facilities. Simply write to

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NEW ENGINEERING IDEAS

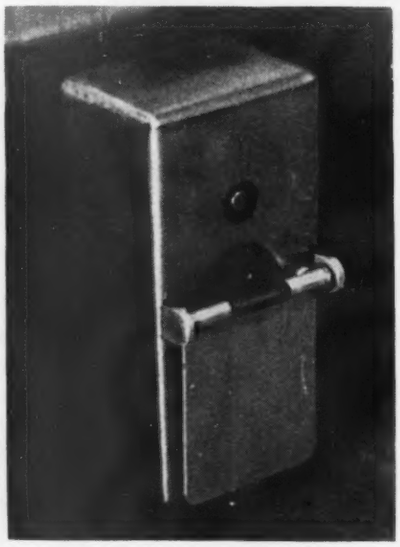
Thermal Device Shows Transformer Overload

Based on the principle that the temperature of the outer case of a transformer is a practical measure of the load conditions existing on the transformer, a thermally operated indicating device has been developed which can be applied without tools. The device is intended to serve only as an indicator that the transformer has at some time operated at a dangerously high temperature and that further investigation, probably by means of more accurate equipment, is necessary.

At the rear of a casing $2\frac{3}{4}$ in. long, $1\frac{3}{8}$ in. wide and 1 in. deep are two permanent magnets which hold the device against the transformer casing. In the same plane with the four magnet pole faces and occupying the space between them is a die-cast aluminum body which acts as a heat-conducting medium. The body incloses a thermally responsive element which in turn actuates a tripping mechanism that releases a flag. The flag is normally held in downward position by a latch, and before operation, presents a surface colored the same as the instrument. Upon latch release, the flag, which is spring-operated, reverses itself and presents to view a differently colored surface the full size of the casing, readily visible from the ground.

The thermally responsive element is adjustable to trip the flag over a range from 100 to 200 deg. F. This adjustment is made in the factory. Further to insure as low a temperature gradient as possible between the exterior of the transformer case and the device itself a plastic cement is first applied to the transformer case. The device is then pressed into place sufficiently hard to assure intimate contact between magnet pole faces and the transformer case. The cement then acts as a windage shield. Laboratory tests indicate a temperature gradient from transformer case to device of only 7 deg. with the equivalent of a 20-mile-an-hour wind.

Since the operating temperature of a transformer is a measure of its serviceability, regardless of external temperature or windage conditions, no ambient temperature correction is necessary.



HELD to a transformer casing by magnetism, this thermally operated device releases a flag as a visible indication that the transformer has at some recent period operated at a dangerously high temperature

Known as the "Thermalarm," the device is offered by the Eastern Specialty Co., 3617-19 North Eighth Street, Philadelphia, Pa.

Timing Discharge of Open Arc Stroboscope

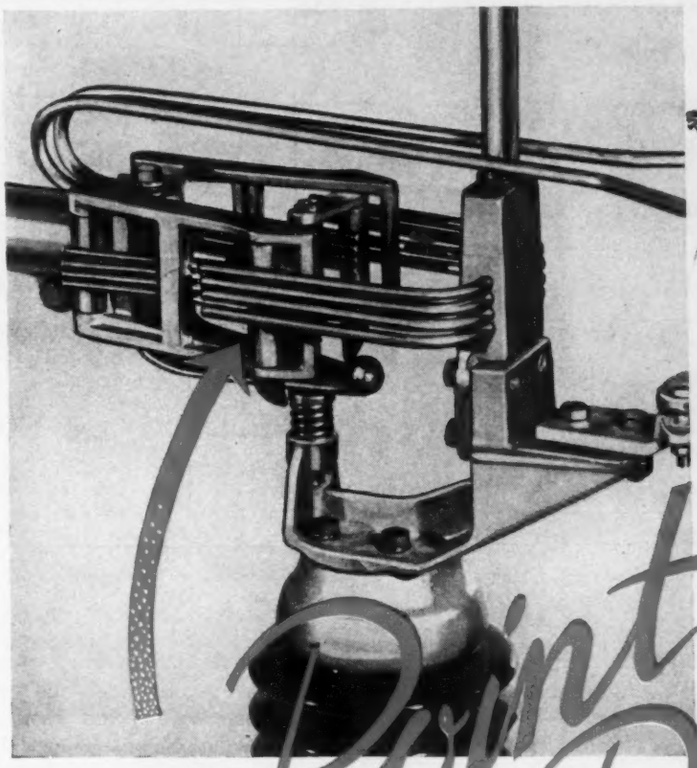
By A. C. HERWEH
Instructor in Electrical Engineering,
University of Cincinnati

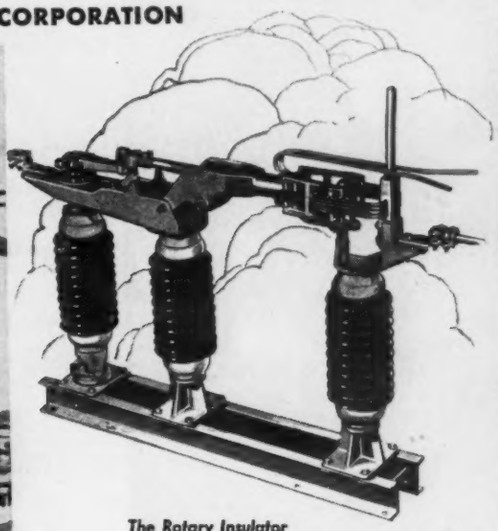
In a practical stroboscope it is essential to produce periodic light flashes of high intensity and short duration. In addition, it is necessary that the time interval between successive flashes be held constant. The duration of each flash and the constancy of the interval between flashes are dictated by the amount of allowable blurring. Moreover, in order to view objects having different periods of recurrent motion, the frequency of the flashes must be capable of variation. An open arc type of stroboscope with electronic timing control will satisfy these requirements for most applications, especially those applications demanding a point source of light.

A stroboscopic arc can be periodically ignited between brass electrodes, by the induction of a high voltage in the coil L, which voltage, on breaking down the main arc gap and ionizing the air between the electrodes, allows condenser C to discharge. The condenser discharge through the gap is not oscillatory as would be expected, but consists of one short pulse of several hundred amperes producing a short brilliant flash of light.

Due to the fact that the coil L must have an air core and low inductance, it is necessary to induce the high ionizing voltage by means of an accurately and positively controlled high-frequency source. A control circuit using an FG-67 Thyratron tube fulfills ignition requirements. This tube is a hot-cathode, mercury-

FROM THE ENGINEERING DEPT.—JAMES R. KEARNEY CORPORATION





The Rotary Insulator Gang Switch 7500 to 115,000 Volt 400-600-1200 Amp.

Multi-Point Pressure CONTACTS

THE successful operation of true, point-pressure contacts on thousands of Kearney Trip-O-Matic Cutouts and Trip-Outs, for years, under all sorts of conditions, was ample recommendation for the adoption of the point pressure contact principle on other Kearney Switching Equipment.

And the principle has lent itself beautifully to Kearney Rotating Insulator Gang Operated Switches.

For one thing, current in these switches is carried to the blade through point pressure bars, thus eliminating flexible braids, ribbons and cables.

And note the illustration above. In closing, the blade enters the point pressure contacts without friction. Then the toggle linkage expands the blade contacts and "wipes-in" a clean, full-pressure contact . . . and, incidentally, the contacts, which are individually sprung, produce a flexing action on opening or closing, which constitutes a mighty convenient sleet breaking action.

Of course, these switches have other refinements, too: extra heavy cross sections to provide safe and sufficient conductivity of loads, over and above the switch current rating; sturdy insulators; balanced leverages for easy operation. But let us give you complete information. Ask a Kearney Representative—or Write.

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4236 Clayton Ave., St. Louis, Mo.
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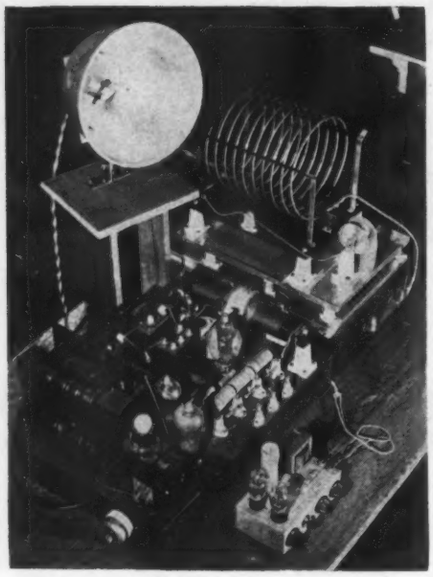
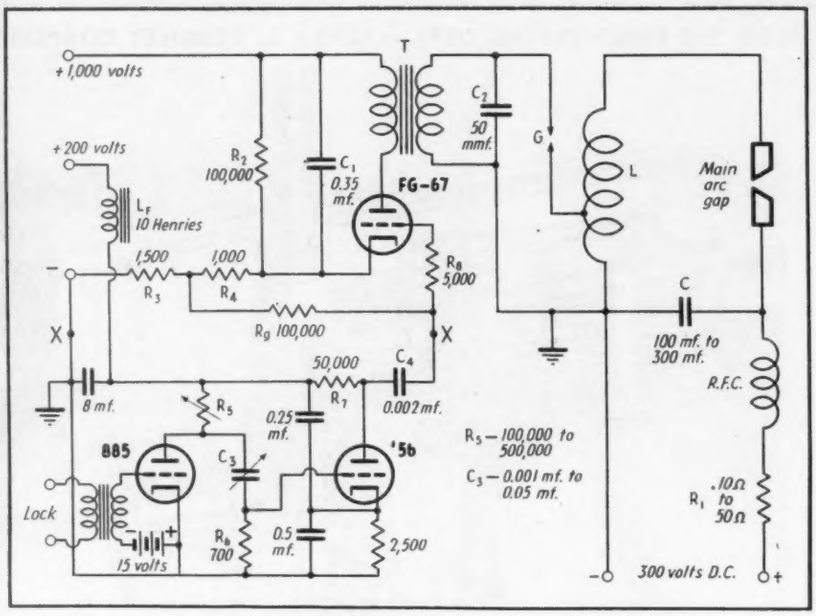




OPEN-ARC STROBOSCOPE with 1,000-volt power supply and electronic timing control

vapor, grid-controlled rectifier obtaining emission from a cylindrical cathode with an inclosed tungsten heater.

In the control circuit condenser C_1 is charged to a potential of 1,000 volts through resistors R_3 and R_4. Current flowing through R_2, R_3 and R_4 causes sufficient negative bias at the Thyratron grid to prevent discharge of C_1 through the primary of the transformer T. A short pulse of voltage applied at the points X-X momentarily reduces the Thyratron grid voltage below the critical value, and C_1 discharges through the transformer primary and Thyratron plate circuit. The transformer secondary charges condenser C_2 until gap G breaks down. The resulting high-frequency oscillations in C_2 and L then cause ignition of the main arc gap. Simultaneously, the Thyratron tube recovers its non-conducting property, condenser C_1 recharges and the control circuit is ready for another ignition operation. The Thyratron may be caused to conduct periodically by repeated voltage impulses applied to the grid circuit at X-X. However, these impulses must be of very short duration to permit the Thyratron to deionize immediately after conduction has occurred.

A rotating commutator supplying a periodic voltage to the Thyratron grid circuit may be used to cause conduction at the required regular intervals, the flash frequency being controlled by the rotational speed of the commutator. This method of control is objectionable in that it involves moving parts. To eliminate mechanical regulation, electrical impulse timing can be secured with a relaxation oscillator using a type 885 tube. This tube is a grid-controlled, gaseous-discharge triode of the heater-cathode type. Operation of the 885 as a relaxation oscillator is possible because a negative voltage on the grid either maintains plate current cut-off or promptly loses plate current control, depending on the plate voltage magnitude. Once plate current control is lost, the grid can regain cut-off control only by a reduction of the plate voltage below the gas ionization potential of the tube.

Oscillator Sequence

In the relaxation oscillator condenser C_3 is shunted across the 885 plate circuit and charged through the current limiting resistor R_5. When the plate voltage on the 885 reaches breakdown potential C_3 discharges through the tube, the plate voltage falls, the grid resumes control and a new cycle begins. The recharging time of the condenser C_3 is determined by the relative values of condenser capacity, current-limiting resistance and charging voltage.

By placing a resistor, R_6, of comparatively low value in series with the discharge circuit of the condenser a source of periodic voltage impulses of exceedingly sharp wave shape is made available by the volt drop existing across the resistor while the oscillator is operating. The voltage thus obtained is amplified by a type 56 tube to give a series of accurately spaced impulses of about 40 volts maximum, which efficiently trip the Thyratron in a positive manner.

•

Arsenic Improves Lead Cable Solder

In reporting on telephone cable-splicing practice in *Metals and Alloys*, E. E. Schumacher and G. S. Phipps of Bell Telephone Laboratories report that the addition of 1/10 per cent of arsenic to an alloy of 37.25 per cent tin, 62.75 per cent lead produces an almost fool-proof solder.

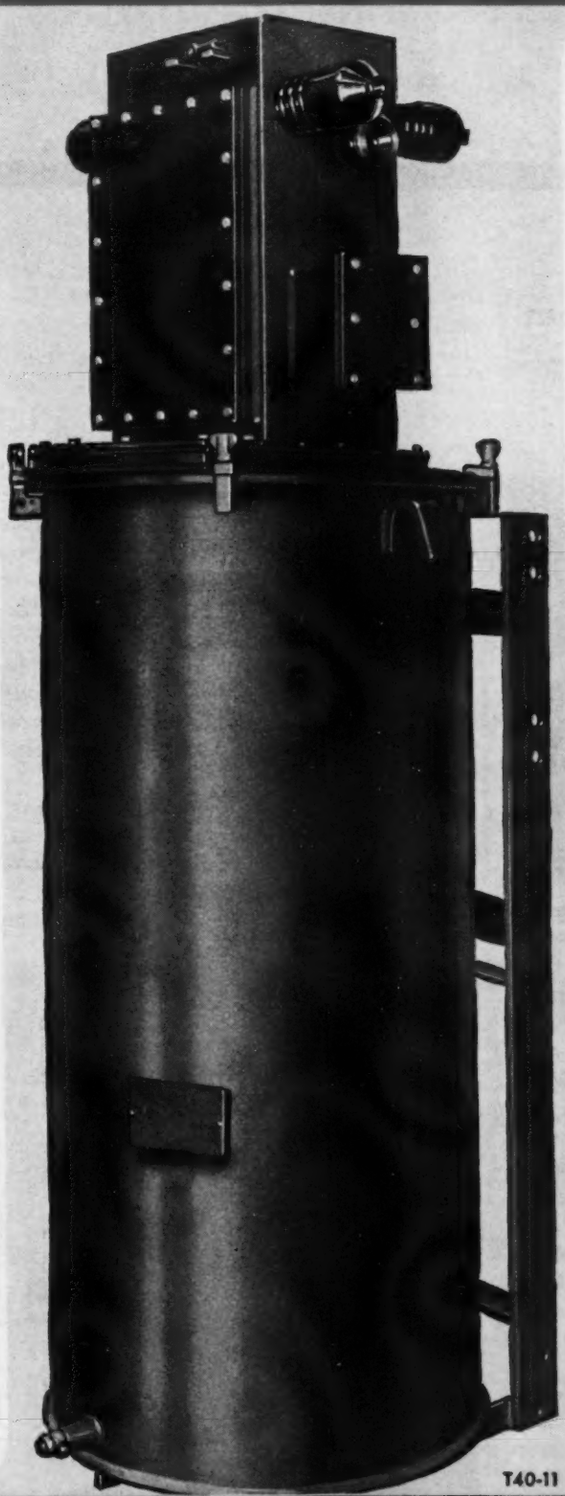
Dross formed on the arsenic-bearing solder is said to be a fraction of that found with the ordinary lead-tin solders, saving skimming time and avoiding porous joints. The solder is more "buttery" for the wiping process and there is no tendency for it to drain away from the partly finished joint.

Splicers from different localities have reported that the solder possesses superior handling properties over the old straight lead-tin compositions. In all instances the joints were pressure-tested after wiping and found sound.

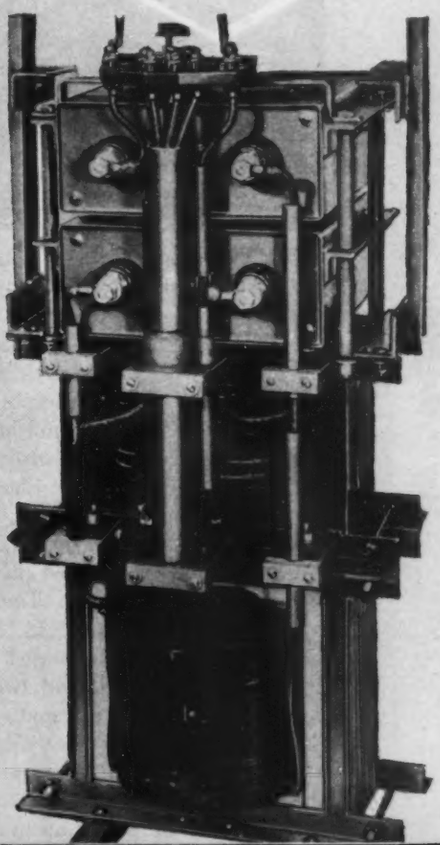
OUTSTANDING FEATURES *of the* WAGNER Y-H CONSTANT-CURRENT REGULATOR

The Wagner Type Y-H Constant Current Regulator furnishes constant current to the lamp circuit from zero load (short-circuited loop) up to full load and even overloads. This new type regulator has many outstanding features, some of which are:

1. UNIT ASSEMBLY—Unit makes a neat and compact assembly. Can be used for pole, platform, or vault installations without reassembly of any parts.
2. NO MOVING COILS—instant adjustment to changes in load.
3. HIGH EFFICIENCY—From fractional to full-load the efficiency is very high.
4. UNITY OR LEADING POWER FACTOR—when the loop is non-inductive the power-factor of the current feeding the regulator is unity. On the other hand, if the loop contains inductive apparatus, the power-factor in the supply line is leading.
5. LOW SUPPLY CURRENT—Under normal operating conditions, the current drawn from the line is extremely low due to the high power-factor and high efficiency of this unit.
6. GOOD VOLTAGE REGULATION—Due to the low supply current drawn from the supply line, the drop in voltage from the power house to the regulator is very small. This is of extreme importance to the small isolated power plants that supply energy to series street lighting systems. The use of the Wagner Type Y-H regulator improves the generator voltage regulation and increases the KW capacity of the generator for useful loads.
7. PROTECTED AGAINST FAULTS IN LOOP CIRCUIT—If a break occurs in the loop circuit, the unit quickly disconnects itself from the supply line. If a short-circuit occurs in the loop circuit, the output current maintains its normal value but the input current drops to a negligible value. Under this condition, the regulator can operate indefinitely without overheating.
8. NON-SPARKING SWITCHING EQUIPMENT—Supply line switch contacts never open or close under load, resulting in practically sparkless operation, long life, and minimum maintenance.
9. EASILY INSTALLED—Since the regulator and switch form a unit assembly it is necessary merely to connect the input and output leads to their corresponding terminals on the unit. In case of remote control, low-voltage control wires must be connected to terminals located in the control-wire conduit box.
10. QUIET OPERATION—The absence of moving parts in the regulator results in extremely quiet operation comparable to that of a standard distribution transformer.



This new type regulator is ideally suited for Series Street Lighting Systems, Boundary and Signal Lighting for Air Ports, Flasher Signs for Advertising, and similar applications requiring constant current at all loads. The regulator casing and the switch housing are mounted into an integral unit resulting in a very compact and rugged arrangement which makes the regulator suitable for pole mounting as well as for vault installations. The overall dimensions have been so selected that the complete regulator can be lowered into a vault through standard size manholes. Other advantages and features of Wagner Y-H Constant-Current Regulator in addition to those listed in the panel at the left, are discussed in Part 8 of Bulletin TU-180. Send for your copy today.



T40-11

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

RANSFORMERS · MOTORS · FANS · BRAKES

LOAD BUILDING

Plant Sign Uses 43,000 Kw.-Hr. a Year

Three new "Zeon" electric signs recently completed by C. I. Brink, Inc., for the Gillette Safety Razor Company in Boston have a connected load (including Telechron clock drives) of 20.5 kw. total. These operate daily from sunset to midnight and have an estimated annual energy consumption of about 43,000 kw.-hr. Electricity is purchased for this service, which represents a modernization of a former display completed in 1926 with older lighting units. There are a main sign, 60 ft. x 51 ft., facing west, the largest illuminated clock sign in New England, and two side signs facing north and south, each 41.5 ft. x 27.5 ft., the total sign area being about one-eighth of an acre, legible from railway, airway, motorway and sidewalk points up to a mile or more from the factory. The larger clock dial is 24 ft. in diameter and those of the two others 17.5 ft. each.

CLOCK SIGNS provide long-hour load of 20 kw. for Boston Edison Company

The total length of tubing is 2,000 ft., the length of electric wiring being 10,000 ft. The light output is 33,500 lumens and the weight of steel structure in all three signs is 34.8 tons.

•

Conditioning Service Boosts Lamp Wattages

By W. S. STRONG
Division Sales Manager
Public Service Company of Northern Illinois
Northbrook, Ill.

A simple, home-lighting demonstration-approach to over-the-counter dispensing of lamp bulbs being used in territory surrounding Chicago by the Public Service Company of Northern Illinois, in conjunction with a free and concessional-price lamp exchange plan, is not only boosting standards of residential illumination but increasing the average wattage of lamps in residential service. In a company store in Evanston, for example, the new dispensing technique has brought such wide acceptance of better lighting that the average wattage of lamps dispensed has increased 6 watts in less than six months.

In developing the dispensing technique now used it was felt that some striking demonstration or leading question was necessary in order to get and hold the attention of the customer who brought in bulbs for exchange. To make such a demonstration possible and practical, a panel approximately 6 ft. in length was constructed and equipped with various fixture applications. Line drawings to illustrate the general type of fixtures found in the community are used. Then, installed on the drawings, the recommended bulb size is shown in its proper use.

Now, as the attendant at the lamp counter accepts burned-out bulbs for

AVERAGE WATTAGE of lamp sales increased 6 watts at this light-conditioning demonstration by Public Service of Northern Illinois

Henry Bulbsnatcher's last stand!

Observe the final desperate plight of the chronic bulb-snatcher! He has robbed one socket to fill another until he is down to the last bulb in the house. If anything happens to that we can foresee only the breakup of a once happy home. The one hope is that with no more bulbs to snatch, Henry will begin life anew by treating himself to a flock of new G-E MAZDA lamps.

May we suggest that you do the same thing yourself before you become a slave to the sly habit of bulbsnatching? Check up now. Do the bulbs in each of your reading lamps total at least 100 watts, well-shaded? (Some need more.) Are they made by G-E? The right bulb can make all the difference between comfort and eye-strain! Get the right size—and insist on the G-E monogram!

THIS COPY GOT A TREMENDOUS READING in a full page G-E ad in the Saturday Evening Post. It typifies General Electric's exclusive "bulb-snatching" story which is being plugged constantly in magazines and radio. Surveys show this "theme" has got all America talking about the need for keeping more right-sized bulbs on hand. If you don't believe it, ask your own family!

G-E MAZDA LAMPS

GENERAL ELECTRIC

exchange and replacement, she picks up a bulb and asks the customer to indicate on this panel where such bulb is used. By snapping on the unit, the customer sees her old bulb lighted and unshaded in contrast with a lamp of proper size shaded in a fixture of the general type found in her home. The lamp clerk, in a few well-chosen words, advises the customer and, in practically all cases, gets a ready acceptance of the proper size bulb. A group of portable lamps (both table and floor) are available near the lamp counter so that the same, quick but careful, advice is given to recommend the proper size bulb in the customer's portable lamp. In the case of the kitchen unit, the fixture is wired so that a customer can see by contrast the difference between an inadequate size lamp and a 100- and 150-watt size. The lamp clerk is well qualified to quote the additional cost per month of using bulbs of higher wattages than the customer brings in for exchange.

In designing this lamp-dispensing unit important consideration was given to shielding the customer's eyes from the glare of bare bulbs during their test by the lamp clerk. A small piece of frosted glass was mounted in the surface of the lamp counter and a standard form of test block was installed underneath. The lamp clerk merely takes the old bulb and pushes the base into the test block, and the lamp either glows or does not glow through the piece of frosted glass.

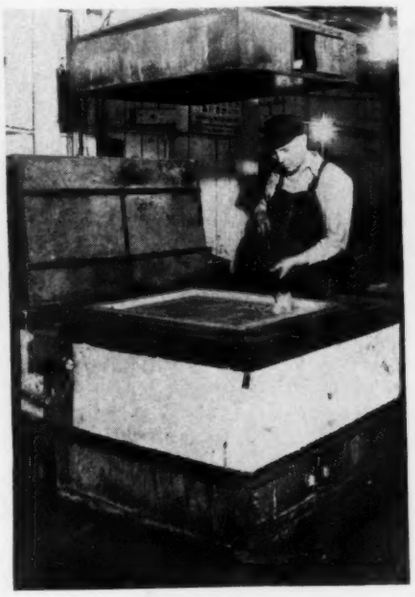
It was felt that the display of lamp cartons was an important factor in bulb sales and shelves were provided in full view for this purpose.

The number of bulbs dispensed at this Evanston store for residential use varies from 12,000 in July to 26,000 in October. Average wattage per lamp formerly was approximately 53. With the trained personnel and the specially designed facility, the average wattage per bulb reached 59 for the 26,000 handled in October, a gain over the previous average of 6 watts per bulb on 26,000 bulbs or 156 kw. of added load.

Electric Heat Aids Electrotyping

Better production of electrotype and engraving plates has been secured at Pacific Electrotype Company, Seattle, by electrically heating the pot used for lead melting. The new equipment was installed with the assistance of industrial engineers for Puget Sound Power & Light.

Holding a charge of 1,500 lb. of lead compound, the pot is brought to working temperature of 750 deg. F. within two hours and by means of time control has been brought to temperature by the time the plant opens in the morning.



APPLICATION of 9.5 kw. of strip heaters to this lead-melting pot resulted in improved operation, better product.

Heat was provided by nineteen strip heaters, which, because of space limitations on this particular equipment, were placed outside the pot. Four inches of magnesium insulation were provided, and a removable, insulated cover cuts heat loss when the pot is not actually in use.

Equipment itself cost about $107 and installation about $337. In use two hours per day, with eight-hour standby, the thermostatically controlled equipment uses 600 kw.-hr.

The particular advantage of electric heat in this application is that the close temperature control yields smoother flowing, more uniform lead, thus appreciably decreasing the extent by which the plates need subsequently be trimmed and cut.

Motor Performance in a Laundry

Tests made by ROY WAGES and ROBERT EDMOND, Georgia Power Company

Equipment Driven	Rated Hp.	Input Kva.	P. F.	Kw.	Hp.	Estimated Hours Use per Month	Estimated Monthly Kw.-Hr.
No. 1 Flatwork ironer	3	3.54	56.8	2	2.68	251	502
No. 2 Flatwork ironer	3	3.31	42.4	1.4	1.88	251	351
Flatwork air compressor	3	2.02	50.0	1	1.34	251	251
Tumbler fan	5	3.9	77.0	3	4.02	200	600
Tumbler drive	2	4.69	64.1	3	4.02	200	600
Dry cleaning room shaft	15	11.64	86.5	10	13.4	377	3,770
Dry cleaning tumbler	½	.....	....	0.4	0.54	377	151
Dry cleaning fan	⅙	.....	....	0.2	0.27	377	75
Dry cleaning fan	¼	.....	....	0.2	0.27	377	75
Dry cleaning dryer	2	.....	....	1.0	1.34	377	377
42 x 84 washer	5	2.06	70.0	1.4	1.88	416	582
40 x 40 washer	3	1.44	83.5	1.2	1.61	416	499
Tolhurst extractor	3.5	2.80	67.8	1.9	2.55	300	570
Extractor	7.5	6.81	29.4	2	2.68	300	600
42 x 84 washer	5	2.99	86.8	2.6	3.48	416	1,082
42 x 84 washer	5	2.40	100.	2.4	3.22	416	998
32 x 40 washer	3	0.895	33.5	0.3	0.40	416	125
42 x 84 washer	5	2.34	85.6	2.0	2.68	416	832
Amer. extractor	3	1.95	56.8	1.1	1.47	300	330
Tolhurst extractor	3	1.75	51.5	0.9	1.21	300	270
Curtain stretcher	¼	....	....	0.2	0.27	50	10
Small extractor	2	1.10	54.5	0.6	0.80	300	180
Handkerchief presser	⅛	....	....	0.2	0.27	416	83
Small flat worker	½	....	....	0.4	0.54	50	20
42 x 60 washer	5	2.72	81.0	2.2	2.95	416	915
Sewing machines (4 @ ¼ hp.)	..	....	....	1.0	1.34	150	150
Water cooler	..	....	....	0.4	0.54	360	144
Coca-Cola machines	..	....	....	0.2	0.27	360	72
Exhaust fan	10	8.54	84.0	7.2	9.65	...	*
Air compressor	5	4.54	57.3	2.6	3.48	450	1,170
	101.0	....	....	...	71.05	...	15,384
Irons, at a total capacity of 13.2 kw; est. demand at 40 per cent				5.3	.....	250	1,325
Lights				6.0	.....	300	1,800
				64.3	.....	...	18,509

* Note — The exhaust fan runs only during summer months.

Every house needs
Westinghouse

BLONDIE

goes to **LEISURELAND**

A WESTINGHOUSE GAME

Copyright 1930-34-35
King Features Syndicate, Inc.

A
TRAFFIC-BUILDING
GAME
to help you push
More free time for Mothers!

FUN FOR EVERYONE *and* BUSINESS *for you!*

Blondie Cutout Display in full color stands 24 inches high—large enough to put in your window. Small enough to stand on the counter.

MORE FREE TIME FOR MOTHERS—This is the dramatic theme that sparkplugs the Westinghouse Fall Activity. It keys a tremendous program backed up by an intensive national advertising campaign.

IN ADDITION—Westinghouse has made available "Blondie Goes To Leisureland"—a timely, traffic-building game. It's a honey! A magnet to draw prospects to YOUR STORE.

IT'S IRRESISTIBLE—Hilarious entertainment built around America's most widely-printed comic strip. Everybody will want one. And you can offer one FREE to everyone who comes in to see your display of Westinghouse Leisure Line Appliances.

IT'S YOUR BABY!

Ask your Westinghouse man to show you *"It's Your Baby!"* . . . the Complete Plan Book that gives all the details of this *new Sales Activity*. Or write to Dept. 213. WESTINGHOUSE ELECTRIC & MFG. COMPANY, MERCHANDISING DIVISION—MANSFIELD, OHIO

Tune in "Musical Americana," N. B. C. Red Network, Coast-to-Coast, every Thursday evening

Westinghouse

THE *Leisure Line* OF *ELECTRIC* HOME APPLIANCES

NEW EQUIPMENT

Test Lamp

In construction, this new test lamp is a modern version of the old lamp on cord tester. It consists of two small lamps

Assembly of two 110-volt lamps for testing 110- and 220-volt circuits; available for testing at higher potentials, but not recommended for use above 600 volts. **Line Material Co.**, Milwaukee, Wis.

screwed into a molded plastic base and connected by 2-ft., well-insulated flexible lead wires to pointed contact prods, which are protected by 5-in. fibre handles. These long handles enable the worker to keep his hands well back from contact points. A transparent molded plastic hood screws over the base, covering the bulbs. This hood protects the worker from flying glass of bulbs in case the lamp is accidentally brought into contact with high-voltage wires. All electrodes and contact parts are sealed into the plastic base, fully protected from water.

•

Constant-Current Regulator

Type Y-H constant current regulator; unit assembly of regulator and controller-protector switch. **Wagner Electric Corp.**, 6400 Plymouth Ave., St. Louis, Mo.

This is said to be the one regulator that has a supply current of unity power-factor when the load also has unity power-factor —and when the load has a lagging power-factor, the input current has a power-factor of approximately the same numerical value but leading. The regulator has no moving coils but operates from no load to full load, immediately adjusting its output voltage to varying load conditions without surges on the line or lamp circuit and is consequently adjusted instantaneously with changes in load. Due to the extremely low current-draw, the supply-line drop is very small. This regulator is stated to be ideally suited for series street lighting systems, boundary and signal lighting for airports, flasher signs for advertising, and similar applications requiring constant current at all loads.

•

Arc Welders

A 200-amp. d.c. arc welder which will provide welding currents from 25 to 250 amp. and a new line of 500-amp a.c. arc welders with built-in power factor correction are recent announcements of this firm. Split-pole cross-field design of the d.c. unit is said to prevent arc "pop-outs" and excessive heat and spatter. When the a.c. welder is operated below half-load, it

200-amp. d.c. arc welder and 500-amp. a.c. welders. **General Electric Co.**, Schenectady.

furnishes leading reactive kva. for shop power-factor improvement; at no load, there is 19.5 kva. available for this purpose.

•

Conduit Fittings

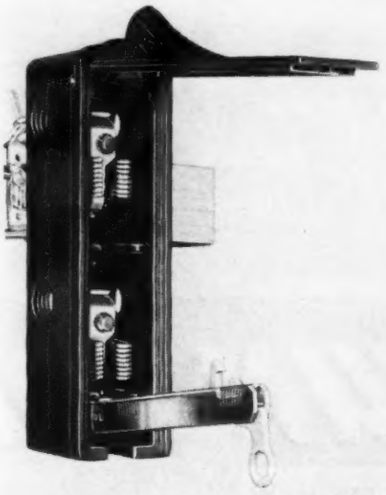
Form 37 "Adalets" conduit fittings; available in sizes up to 2 inches. **The Adalet Mfg. Co.**, Cleveland, Ohio.

New conduit fittings have smooth curves on the inside to protect against mechanical abrasion and also to provide ease of pulling wires.

ELECTRICAL EQUIPMENT BUYERS look first in "Electrical World" *Electrical Buyers Reference* for names, addresses and products of manufacturers.

Disconnect Switch

To permit greater flexibility in sectionalizing and interconnecting distribution feeders, this company offers a dead-blade



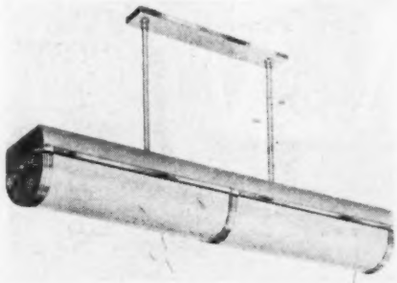
Dead-blade porcelain-housed disconnect; 400 amp. **James R. Kearney Corp.**, St. Louis, Mo.

porcelain-housed disconnect in 400-amp. size. Like its 600-amp. counterpart, it employs multi-point pressure contacts for cool operation and has an expanding latch to facilitate opening and closing.

•

Commercial Fluorescent

New fluorescent luminaire for commercial interiors is offered, with or without glassware, in suspension and ceiling types.



Type "CL-110" direct-indirect fluorescent luminaire. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

THE NEW MODE IN STREET LIGHTING BRACKETS

GREATER ROAD CLEARANCE
ON SAME SIZE POLES

DRAINAGE AWAY FROM LAMP

MORE LIGHT AREA FOR SAME
MOUNTING DISTANCE FROM GROUND
DUE TO INCREASED HEIGHT OF LAMP

ENABLES USE OF SHORTER POLE WITHOUT
LESSENING LAMP HEIGHT

ONE SCREW, ORNAMENTAL PENDANT,
ALIGNMENT SETTING ALLOWS QUICK
ADJUSTMENT OF LAMP TO LEVEL POSITION

CAN BE OBTAINED WITH POLE PLATES FOR
WOOD OR STEEL POLES WITH INTERNAL OR
EXTERNAL WIRING

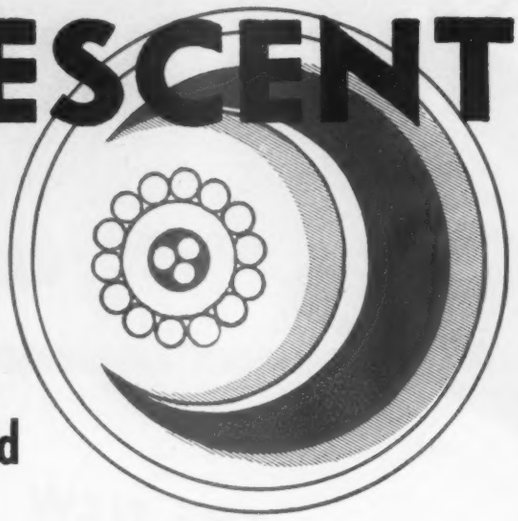
FOUR—SIX—EIGHT—TEN FEET EXTENSIONS.
1¼—1½—2-INCH PIPE

HUBBARD AND COMPANY
PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

RUBBER COVERED POWER CABLES • BUILDING WIRE

CRESCENT

Makes a Complete Line of BUILDING WIRES and CABLES



A complete line for every wiring need, engineered and built for longer service and maximum performance even on the toughest assignments.

CRESCENT SUPPLIES

the following choices of insulation for standard building wires and cables:

Code Grade, Type R
30% Performance Grade, Type RP
ENDURITE Heat Resistant, Type RH
IMPERVEX Moisture Resisting Grade, Type RW
SYNTHOL Synthetic Insulated, Type SN

And here is a partial list of CRESCENT products:

Genuine A.B.C. Armored Bushed Cable
Flexible Steel Conduit
Bare Copper Wire and Cable
Flexible Cords
IMPERIAL Portable Cords and Cables
Parkway Cables
Rubber Power Cables
Service Cables
Signal and Control Cables
Trench Cables
Varnished Cambric Cables
Weatherproof Wires and Cables

CRESCENT INSULATED WIRE & CABLE CO. INC.
TRENTON, NEW JERSEY

Atlanta Baltimore Boston Buffalo Chicago Cincinnati Cleveland Detroit Indianapolis Kansas City Los Angeles Minneapolis New Orleans New York Philadelphia Pittsburgh St. Louis San Francisco

CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

ARMORED CABLE • VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES

CRESCENT ENDURITE SUPER - AGING INSULATION

Suspension type uses two 40-watt 48-in. lamps for downward illumination with one 30-watt, 36-in. lamp for an indirect component. Ceiling type uses only the two 40-watt lamps. Glow-switch starters and twin-lamp ballasts with built-in capacitors are used.

•

Circuit Breakers

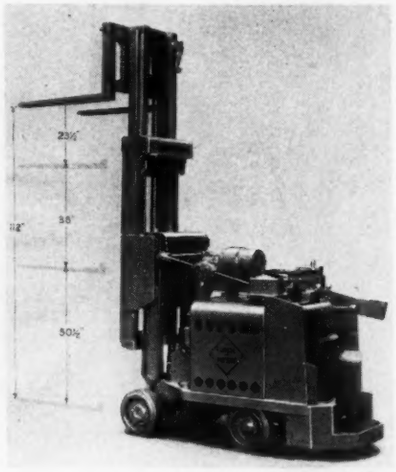
Type "M" Multi-breakeR; capacities from 15 to 100 amp. **Square D Co.**, Detroit, Mich.

"Multi-breakeRs" are now available for use on three-phase, four-wire solid neutral 120/208-volt a.c. system. Three-pole breakers with neutrals are used for this service. Trip-free breakers are also common-trip; when an overload or short-circuit occurs on one pole, all poles trip simultaneously.

•

Elevator Fork Truck

This triple-lift truck is driven by a four-pole, series-wound motor, capable of sustaining a 500 per cent overload. It is direct-connected to a free-coasting worm and gear and drives the two wheels near-



Telescoping elevator fork truck, type ERS-3T, lifts to three levels, 50½, 88½ and 112 in. **Elwell-Parker Electric Co.**, Cleveland, Ohio.

est load, assuring ample traction. Power source can be either acid or alkaline storage batteries. No fuses are needed to protect motor. When lowering load, regenerated power is returned to the battry. Hoist is operated by a separate motor controlled by push-button and is provided with ratchet device, which operates when the descending load meets an obstruction. A slip clutch serves the same purpose when ascending loads are obstructed. A solenoid brake locks the hoist load in any position. Fork arms of truck are supplied in a variety of dimensions to suit application.

•

Electric Heater

"Safety Heater;" 1,000 watts; 115 volts, a.c. or d.c. **Noma Electric Corp.**, 55 West 13th, New York, N. Y.

As a safeguard against fire, electric shock or burns, this heater makes use of a non-glowing, woven electric element. Heating element is insulated to prevent short circuits. If the convection heater should be tipped over, the current is automatically turned off.

Sisters Under the Skin — are
THE COLONEL'S LADY and JUDY O'GRADY
The Right Side
The Wrong Side
"The Railroad Tracks" Divide Two Classes of Homes!
J.O.

This is the Colonel's Lady's Neighborhood. The chances are that a big majority of your Electric Range Owners are here. Because the monthly electric bills from most of these higher-income homes are above $1.75 (or whatever your "break-even" figure may be) they are *profit customers.*

Over here is where Judy O'Grady lives. YOU LOSE MONEY EVERY MONTH IN SERVING MOST OF THESE HOMES. But this needn't continue, because JUDY O'GRADY WANTS ELECTRIC COOKING!

ELECTROMASTER

(Detroit manufacturer of Electric ranges and water heaters) has a plan to turn Utility's Loss Customers into Profit Customers. Use the coupon to get the outline of this complete load-building plan. See if it isn't exactly what you've been looking for!

(For Electric Utility Executives Only, Please)

ELECTROMASTER, INC.
1803 E. Atwater St., Detroit, Michigan

Yes, we'd like to look over this plan—particularly your *proofs that it works.* This request puts us under no obligation.

Utility.....

By.....

Title.....

Address.....

A 2-WAY BOOST to "lifting" efficiency

Sensitive control, adequate power and long life are all-important features of a good electric hoist. The same immediate and accurate response to your needs, day after day, is the main requisite of a good supply source. So, why not take advantage of a combination of both—the Coffing Quik-Lift Electric Hoist plus GRAYBAR'S one-call supply service.

The Quik-Lift can be plugged into any AC or DC circuit connection... has a heavy-duty motor... sensitive control permits load to be raised or lowered to a fraction of an inch... range of models is from 250 lb. to 4,000 lb. capacity.

Write today for prices, specifications on the Quik-Lift Electric Hoist or any other electrical tools or supplies. Graybar Electric Company, Graybar Building, New York.

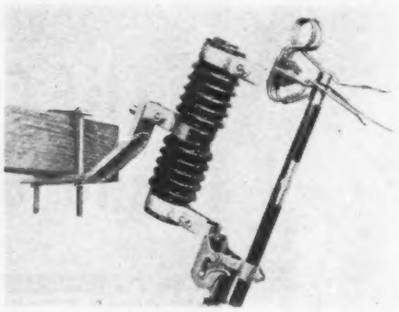
GraybaR
HEADQUARTERS for FLUORESCENT LAMPS—ACCESSORIES—REFLECTORS

OFFICES IN OVER 80 PRINCIPAL CITIES

GraybaR QUALITY Since 1869 — Everything Electrical — GraybaR ELECTRIC COMPANY

Dropout Cutout

Fuse holder drops out of contact when a short occurs, swinging to the open position. Cutout has single-piece insulator,



Dropout cutout type "ET-3"; in 5-kv., 7.5/12-Y kv., and 15-kv., 100 amp., **Pacific Electric Mfg. Corp.**, San Francisco, Calif.

solderless-type connectors and interchangeable lower hinge for mounting spare fuseholders.

•

Graphic Meter

Supersensitive recorder; in seven cases, including portable type; 6-in. chart. **Esterline-Angus Co.**, Indianapolis, Ind.

A direct-writing recorder that comes to full scale on one milliampere has been developed for use with apparatus where the recording of minute currents is a problem. New measuring element employs an intense magnetic field produced by larger "Alnico" magnets and a moving coil with an increased number of turns of "Formex" wire. Writing pen is actuated directly by the moving coil. New measuring element also makes possible high-speed recording voltmeter with the sensitivity of 1,000 ohms per volt, for ground detection voltmeters to measure very high resistance grounds.

•

Intercommunicating System

Six or more remote stations may be called individually or simultaneously from the plant manager's desk equipped with this new intercommunicating system. Remote control feature of the system is said to permit employee's conversation from any part of the floor, without approaching the station, making for a minimum of work-interruption.

"Twinphone" multiple master station. **Executone, Inc.**, 415 Lexington Ave., New York, N. Y.

•

Lamp Lock

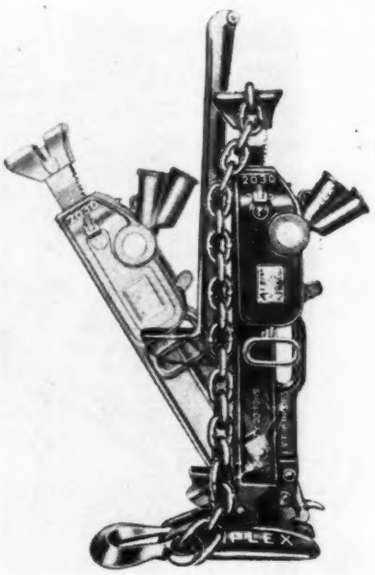
Lamp locks; for brass and porcelain sockets, also weatherproof socket with locking device attached. **Laduby Co.**, New Haven, Conn.

Device for locking electric light bulbs makes use of convolutions on outside of threaded brass ferrule. Large end of tapering coil spring is screwed into socket, leaving three or four turns of spring exposed. Protecting ring with notch at top is dropped over light bulb and the bulb screwed into the socket, engaging the exposed spring turns in the threads on the bulb base.

•

Heavy-Duty Jack

Jack with a 20-ton lifting and holding capacity on either the cap or toe lift is offered for use by utilities and others using heavy machinery or faced with possible emergencies requiring the use of a



"No. 2030" heavy-duty jack; 30 in. high, with 17¾-in. lift; weighs 167 lb. complete. **Templeton, Kenly & Co.**, Chicago, Ill.

heavy-duty jack. Besides lifting on cap and toe, the jack lifts on the auxiliary shoe which hooks into the cap or on the chain with grab hook end. In addition to lifting and lowering vertically, the jack tilts on its base for jacking at an angle.

•

Etching Tool

"Universal" etcher; standard model for 110 volts, 60 cycles. **Ideal Commutator Dresser Co.**, Sycamore, Ill.

Etcher tool and cords, switch and indicator lamp are all enclosed in a new portable electric etcher. Small objects are etched on the work plate making up part of the case while a ground clamp is furnished for larger objects. Etching heats are 120, 240, 420 and 700 watts; red indicator lamp glows more brightly as heats are increased.

MANUFACTURING - MARKETS

Expansion at Three G.E. Plants Planned

Expansion of present facilities for manufacturing propulsion equipment for the United States Navy, requiring an expenditure of approximately $11,500,000, has been announced by General Electric Co.

Charles E. Wilson, president, emphasized that the move is in line with the company's policy of anticipating, so far as is possible, the requirements of the defense program for regular lines of General Electric equipment.

The plan involves equipping an existing building at the company's Erie, Pa., works with heavy machinery for the manufacture of large steam turbines required by destroyers and light cruisers, and enlarging two of the company's Lynn, Mass., shops where reduction gears for the propulsion equipment is made.

"The additional facilities obtained from this expenditure will release available capacity at Schenectady for the manufacture of the larger turbines for battleships as well as those regularly manufactured for utility customers," Mr. Wilson said. "At the present time General Electric has on order, or is building, land and marine turbines totaling 6,000,000 hp., 3,000,000 hp. of which is for United States ships."

•

Defense Orders Will Not Curb Normal Production

The placing of a $20,000,000 machine gun order with Frigidaire Division, General Motors Corp., announcement of which was recently made, will not interfere with the manufacture of the company's regular products, according to a statement issued by E. G. Biechler, general manager.

"Manufacture of household electric refrigerators and ranges and commercial refrigeration and air-conditioning equipment will continue unimpeded by the additional activity required in the production of machine guns in our plant," Mr. Biechler declared.

"The task of providing machine guns for the government will be carried out with the use of additional facilities, including a new five-story factory building. The regular line of products, therefore, will be manufactured on an uninterrupted schedule in the plants and with the machines ordinarily used for this purpose."

•

Electric Sales Dip in July; Over 1939

Sales of electrical goods by 352 wholesalers in July were 6.6 per cent less than in June but 20.7 per cent more than in July of last year, according to the Electrical Division, Department of Commerce. Cost value of inventories at the end of the month was down 1.6 per cent from June but up 12.9 per cent over last year's July.

A larger relative decline in sales increased the ratio of stocks to sales by 5 and 11.6 per cent, respectively. Accounts receivable by 317 wholesalers rose, correspondingly, by 2.3 and 14.6 per cent.

Sales by household appliance dealers, 298 firms, decreased 18.1 from June, but rose 21.5 per cent over July, 1939. For the seven-month period ending in July sales were 15.9 per cent more in 1940 than in 1939.

•

Stockholders Increase

The number of General Electric stockholders on September 20, record date for the October 25 dividend, was 211,611, it was announced by President Charles E. Wilson. This is an increase of 1,758 over a year ago and about 500 more than the previous record date, June 28, 1940.

Allis-Chalmers Head Reports on Defense

Allis-Chalmers Manufacturing Co. is preparing for an active part in the national defense program, Max W. Babb, president, stated in a letter sent to stockholders this week.

The company now has on hand government orders for additional turbines for Boulder Dam, Pickwick Landing, Wilson Dam, as well as orders for the national defense program, he stated.

Incoming business of the company during the September quarter of 1940 continued to run well ahead of a year ago and probably at about the same level as in the second quarter of this year, when orders booked reached $27,430,565. In the September quarter of 1939 orders booked aggregated $19,710,020.

Sales billed during the third quarter this year also probably continued about on a par with the $25,125,447 volume of the second quarter, which would represent a substantial gain over the $18,363,045 total for the September quarter of 1939.

•

General Cable Drops Plan

Stockholders of the General Cable Corp. at an adjourned special meeting in Jersey City on September 24 voted to adjourn sine die without taking any action on the proposed recapitalization plan for the company. Dwight R. G. Palmer, president, said adjournment amounted to withdrawal of the plan because of failure of two-thirds of each of the three classes of stock to give consent.

•

Vacuum Cleaner Sales Up

Vacuum Cleaner Manufacturers Association reports August industry sales of vacuum cleaners show an increase over the same month of previous year

of almost 15 per cent, with a total for the month of 110,867 units, as compared with 96,601 units for August of last year. The total for the eight months is 1,136,489 units, against 879,543 units for the similar period of 1939, an increase of 29 per cent.

•

Instrument Manufacturers Report Increased Output

Manufacturers of electrical measuring instruments in the United States reported a slight increase in production for 1939 as against 1937, according to preliminary figures released by the Bureau of the Census.

In 1939 there were 59 establishments —as against 33 in 1937—paying an average of 6,976 wage earners a total of $9,881,124 in wages during the year, an increase of 0.6 per cent in number of wage earners and a decrease of 2.2 per cent in wages, when compared with 1937. Value of products amounted to $41,797,495, an increase of 3.4 per cent over 1937.

•

Manufacturers Make New Appointments

Line Material Co. has announced the appointment of W. T. Barber as manager of the Denver division. W. T. Smith, district manager, has moved from the Denver office to Salt Lake City.

Cutler-Hammer, Inc., has appointed R. L. Hibbard, formerly of the company's New York office, to the merchandising sales staff of the Detroit office. Mr. Hibbard has been connected with Cutler-Hammer since 1936.

Standard Transformer Co., Warren, Ohio, has announced the appointment of H. G. Johnson, 1124 Park Square Building, Boston, Mass., as New England sales representative, effective November 23.

•

Sangamo Raises Dividend

Directors of the Sangamo Electric Co. have declared a dividend of 37½ cents per share on the common stock, payable October 1 to holders of record September 16. This compares with 25 cents paid on July 1 and April 1.

New York Metal Prices

	Oct. 1, '40 Cents per Pound	Sept. 25, '40 Cents per Pound
Copper, electrolytic	12.00*	12.00*
Lead, A. S. & R. price	5.00	5.00
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc, Spot	7.64	7.64
Tin, Straits	51.50	50.10
Aluminum, 99 per cent	18.00	18.00

*Delivered Connecticut Valley.

Field Reports on Business

Near-capacity levels of business are now current in such heavy goods industries as major electrical equipment, machine tools, heavy machinery, steel, shipyards and aircraft. For the second successive week engineering construction awards exceeded $100,000,000. Defense orders for the past 60 days total six billion dollars.

NEW YORK

Business moves along a broad front as consumption goods, durable goods and prices continue their upward trends. Huge orders for defense preparations are appearing day by day and for the past 60 days they total in the vicinity of $6,000,000,000.

Electric power consumption is practically at a record figure, total carloadings are expanding rapidly and steel operations are holding on at a level just below the peak of last fall. Automobile production has been increased rapidly and already exceeds the industry's normal weekly capacity rate of 100,000 cars.

The demand for copper and other nonferrous metals is now being evidenced by increases in quoted prices for copper, lead and zinc. Speaking of prices, Chairman Ryerson of Inland Steel sees no present prospect of increases in steel. With regard to scrap, President Jacobson of the Institute of Scrap Iron & Steel says scrap exports to Japan have been 2½ per cent of 1940 American requirements and Pacific Coast scrap inventories would be a surplus pool for U. S.

Clues to truck prices and prices for passenger cars used by utilities' personnel are seen in 5 to 10 per cent increases in Ford, with average increase $50 per car, and low-priced "60" series discontinued. Chevrolet has discontinued its lowest-priced Master 85 series based on $659 for the business coupe. Retail prices now start at $712 for a "master deluxe," up 4 per cent over last year's corresponding model.

Utility earnings are picking up slowly but surely as output rises, but so far most of it is power sold for 1.1 cents per kilowatt-hour (average for nation). Cantonment business will probably be master metered, but defense workers will soon boost usage billed on residential rates.

PACIFIC COAST

It is estimated that Pacific Coast shipbuilding, both naval and commercial, now building or allotted, totals $650,000,000 in value, of which two-thirds went to the San Francisco Bay area; furthermore, that electrical equipment therein averages 10 per cent for wiring, auxiliaries and steam turbine-generators, and that skilled labor averages 30 per cent of the value of each vessel. Pacific Gas & Electric Co. is building an $80,000 substation at Sonora, in the Sierra mine district, and a 50,000-kva. substation, costing $750,000, near San Mateo on the San Francisco Peninsula to cope with the record-breaking home load, increase thereon and its potential appliance opportunities.

Industrial business includes a $1,291,800 air corps contract for field lighting sets to Lights, Inc., of Alhambra; a $20,000 order from Bethlehem of San Francisco for G.E. pyranol transformers and switchhouse; $10,000 in transformer repairs to city of Alameda, which is also making a $35,000 extension to handle the adjacent naval air base. War Department's Anchorage, Alaska, power plant will cost $1,600,000.

Despite all this huge prospective electrical business, September billing was a bit disappointing, though October promises well, through placing and shipping of business now pending.

CHICAGO

Substantial gains were recorded during September in most lines of business in this district. Although the defense program continued to be a major factor in stimulating industry, normal domestic business has increased rapidly in the last month.

Orders of lamp manufacturers gained 32 per cent from last year, with the demand becoming steadily greater. Major appliance sales advanced 28 per cent from a year ago, reflecting in part a higher priced unit buying trend.

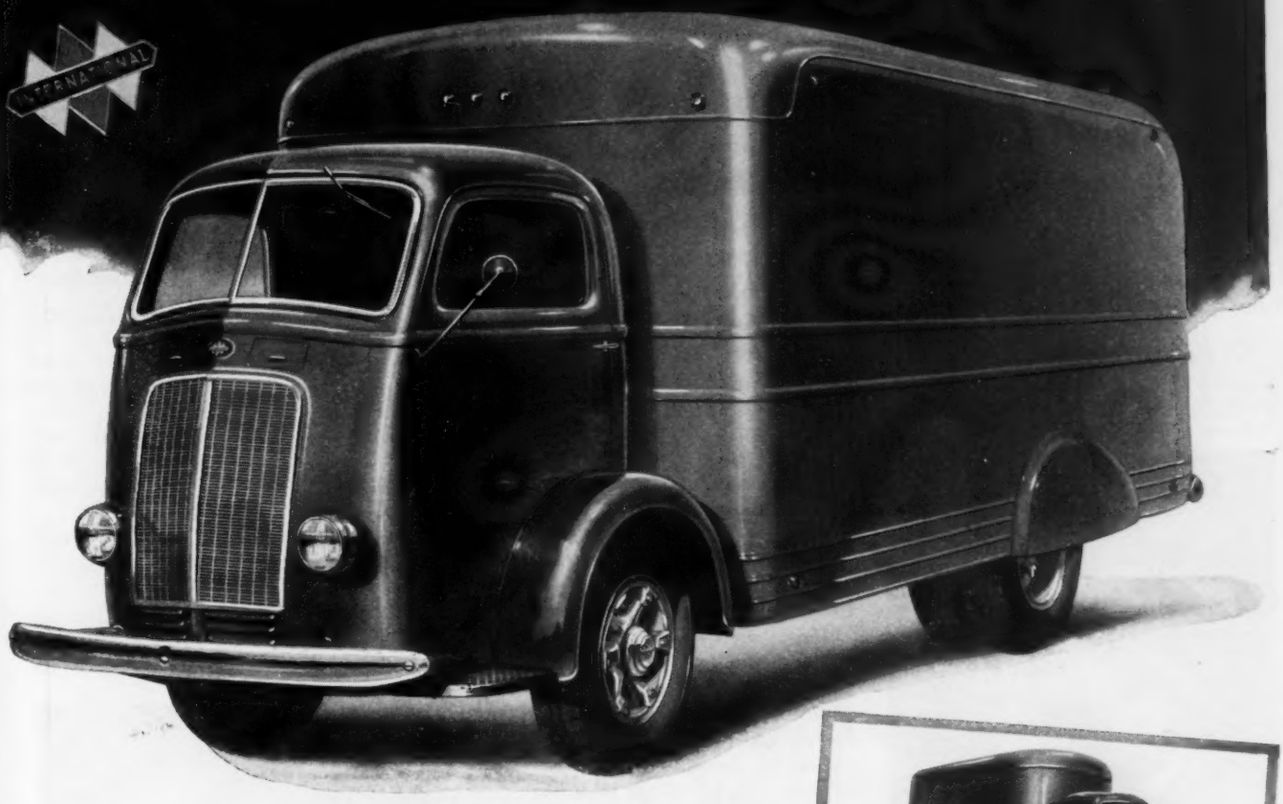
Orders for electrical equipment placed last week include $459,140 for telephones, $138,000 for submarine cable, $300,000 for motors and control apparatus for mining machinery, $4,171 for sodium-vapor lights and a 15,000-kw. turbo-generator. Manufacturers report substantial orders for transformers, capacitors and switchgear. There is a heavy demand for motors and control equipment from machine tool makers.

NEW ENGLAND

New England industrial operations continue on an unprecedented scale and the third quarter of 1940 sales of electrical equipment already have passed all previous records. Marine propulsion machinery and proposals for a large variety of auxiliary electrical apparatus submitted by the Navy Department are receiving special attention at this time by manufacturers; small motor sales are running ahead of all expectations and predictions for a "tremendous" activity continuing through the coming year are heard frequently among machine tool builders. Large motor sales are forging ahead; orders included several units ranging from 50 hp. to 300 hp. and during the past week this trend was maintained. Inquiries for small substation equipment have been made by a number of industries which are planning plant expansion. President Campbell, Connecticut Light & Power Co., stated to the ELECTRICAL WORLD last week that his company had reached an all-time high in weekly generated output during September, due in substantial part to industrial energy consumption and including all classes of service.

Hartford Electric Light Co. has completed a 22-kv. overhead crossing over the Connecticut River; this company has purchased 18,600 ft. of 27.5-kv., three-phase gas-filled cable from General Electric Co. for local use. Simplex Wire & Cable Co., Cambridge, Mass., has received a $195,340 submarine mine cable order; other contracts awarded a short time ago for electric cable include $50,820 to American Steel & Wire Co., Worcester, Mass., and $15,287 to Collyer Insulated Wire Co., Pawtucket, R. I.

NOW *a Full Line* OF CAB-OVER-ENGINE INTERNATIONALS!



Here's the New Model D-400

You've always wanted an *in-between* capacity, real cab-over-engine truck.

Well, here it is—International's brand-new D-400 — styled to the minute, incorporating ideas from both smaller and bigger models in the line, to make *the best all-around traffic-type job on the street.*

Like all c. o. e. Internationals, the D-400 keeps its perfectly insulated engine *under the seat.* The engine is completely accessible and readily serviced. Load distribution is the ideal ½-½, balanced on front and rear axles and all four wheels.

The driver of this handsome truck gets all the breaks that make for efficient, safe operation. The cab provides wide visibility, perfect ventilation, nicely placed controls, and a comfortable adjustable seat. Brakes are hydraulic. Behind the driver is *maximum-load space and short-wheelbase maneuverability.*

Yes sir, cab-over-engine design solves the "tight-hauling" problem ... And now you can go *completely* INTERNATIONAL in c. o. e. models. This new D-400 fits in the broad middle range between the very popular D-300 (13,200 lb. g. v. w.) and the beautiful heavy-duty D-500 and DR-700 (18,800 lb. and 26,900 lb. g. v. w.). Tell the International dealer or branch you want to *"see and drive the new Model D-400!"*

SURPRISING UTILITY!

The International D-400 is perfectly adaptable to MANY body and load variations. Four are shown here. Gross weight rating is 16,200 lb. And you can have the 2-speed-axle DS-400, with its extra-high ratio for economical *speed* and its extra-low ratio for economical *power.*

Rely on International ALL-TRUCK Trucks. In addition to the cab-over-engine sizes, the line includes standard chassis from ½-ton light-delivery trucks to big 6-wheelers.

INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago, Illinois

INTERNATIONAL TRUCKS

NEWS ABOUT PEOPLE

W. R. Schofield Promoted by Leeds & Northrup

W. Richison Schofield, formerly chief engineer of Leeds & Northrup Co., Philadelphia, Pa., has recently been appointed director of engineering. John W. Harsch, assistant chief engineer, has been advanced to chief engineer and Mr. Harsch's former position has been filled by the promotion of John F. Quereau.

Blank & Stoller

W. R. Schofield

J. W. Harsch

Mr. Schofield joined Leeds & Northrup in 1916 and since 1928 has held the position of chief engineer. An authority in pyrometry and automatic control, he holds important patents in these fields. He is an active member of the committee on industrial instruments and regulators of the American Society of Mechanical Engineers and of the committee on electrochemistry and electrometallurgy of the American Institute of Electrical Engineers.

Mr. Harsch joined Leeds & Northrup in 1924 and in 1928 became assistant chief engineer. He is largely responsible for the design of the Homo tempering and Homocarb carburizing furnaces; is vice-chairman of the Philadelphia chapter of the American Society for Metals and as a member of the American Society for Testing Material is chairman of the subcommittee on life-testing nickel-chrome resistor materials.

Mr. Quereau has been with Leeds & Northrup since 1929.

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▶ LLOYD E. LUCKMAN has been appointed acting manager of the St. Paul office of the Graybar Electric Co., Inc., succeeding W. H. HOLDORF upon his retirement from the company. Mr. Luckman commenced his career with Graybar in 1914 and has served continuously in various business capacities in the Minneapolis territory since that time. Among his other activities in the electrical industry has been membership in the Minneapolis Electrical League and the Illuminating Engineering Society. Mr. Holdorf joined Graybar in 1908, serving first in the Chicago office and later in Cincinnati and St. Paul. From 1915 to 1917 he was connected with the Northern Electric Co. in Minneapolis and from 1917 to 1920 with the Western Electric Co., in that same city. In 1921, he rejoined Graybar as manager of the St. Paul office.

Consumers Power Names Brewer Purchasing Agent

Horace L. Brewer has been appointed purchasing agent of the Consumers Power Co., to succeed the late Charles L. Rice. Mr. Brewer was formerly purchasing engineer for Commonwealth & Southern Corp., northern division, with headquarters in Jackson.

His connection with what is now Commonwealth & Southern began in 1924 when he joined Hodenpyl, Hardy & Co., at Peoria, Ill., as a draftsman. He went to Jackson first in October, 1926, worked for several months on steam pipe layout problems for the old Commonwealth Power Corp., then went to Springfield, Ohio, on construction work. In March, 1928, he returned to Jackson, and in November, 1931, he was assigned to purchasing work for Consumers Power Co. He became purchasing engineer for the Commonwealth & Southern Corp., northern division, in January, 1937.

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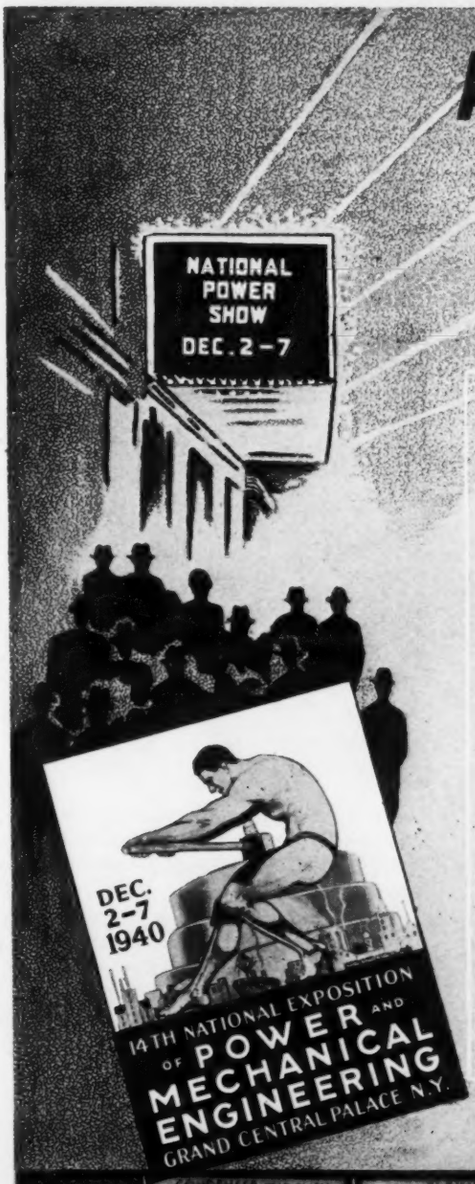
▶ ROBERT T. SWAINE of New York was recently elected a member of the board of directors of the Westinghouse Electric & Manufacturing Co. Mr. Swaine

AMERICAN INDUSTRY NEEDS ENGINEERS WITH VISION


NATIONAL POWER SHOW
DEC. 2-7
DEC. 2-7 1940
14TH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING
GRAND CENTRAL PALACE N.Y.

The electrical industry must and will adapt itself to the major changes taking place in the generation and use of power. Only men of vision can direct the electrical industry's task of distributing and applying the changing and expanding power resources of our Nation. Only men familiar with the newest power equipment can make the most of their opportunities to plan and effect the most efficient use of power as electrical energy for new installations and to meet modern requirements in existing plants.

Whether your interests lie in the production, sale or use of electricity, come to this year's National Power Show. It provides a timely and outstanding opportunity to bring your education and experience fully up to the form fit for these fateful forties. Come and bring your associates to this biennial post-graduate course for engineers. Reap rich rewards in added ability to serve, to lead, to profit.

LOOK, LISTEN, COMPARE, APPLY

More than 300 exhibitors . . .
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Hundreds of live displays—3 floors—at the Power Capital of the World
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Power generation, transmission, and application
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Methods, machinery, equipment, materials, instruments, tools, supplies, services
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Hundreds of experienced engineers in attendance at exhibits to discuss your problems, answer your questions, demonstrate displays
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A preview of Power progress
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Admission is by registration.
You are cordially invited to attend

14th NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING . .

GRAND CENTRAL PALACE · NEW YORK · DEC. 2-7, 1940

Management, International Exposition Co.

has been a member of the law firm of Cravath, de Gersdorff, Swaine & Wood since 1917.

▶ WILLIAM GORDON has been appointed purchasing agent for the B. C. Electric Railway Co. to fill the vacancy caused by the death of A. C. W. Gage. Mr. Gordon has been with the B. C. Electric for the past 33 years.

▶ A. H. CUNNINGHAM was elected assistant treasurer of the Westinghouse Electric & Manufacturing Co. at a recent meeting of the board of directors. A native of Pittsburgh, Mr. Cunningham entered the employ of the Westinghouse Machine Co. as a cost clerk in 1915, and was later transferred to the Westinghouse steam division at South Philadelphia as chief clerk. From 1922 to 1926 he was stationed at the East Springfield, Mass., plant of the merchandising division as assistant works auditor, and he returned to the East Pittsburgh offices of the company in 1926 to handle special accounting work. In 1928 he was elected auditor and assistant secretary of the Westinghouse Electric Elevator Co., in Jersey City, N. J., became assistant treasurer and auditor in 1933, and in 1935 treasurer and auditor. A year ago Mr. Cunningham was transferred to the treasury department of the Westinghouse company at Pittsburgh, to serve as assistant credit manager.

OBITUARY

A. Edward Newton

A. Edward Newton, prominently identified with the electrical manufacturing industry for 36 years, and noted author and book collector, died in Philadelphia September 29, after an illness of three years. He was 76 years old.

Mr. Newton entered the electrical business in 1895, when he made a considerable investment in the Cutter Electrical & Manufacturing Co., now the I-T-E Circuit Breaker Co., and became its treasurer. The company was then in receivership, the circuit breaker was hardly more than an idea and the business of the company consisted almost exclusively of the manufacture and sale of push-button switches for

lighting circuits. Mr. Newton's conception of his duties as treasurer included the shaping of the policies and management of his company with a view to making its operations financially profitable.

In 1900, by which time the standing and reputation of the Cutter Company had become firmly established, Mr. Newton assumed the presidency of the company and continued in that capacity until 1927, when he became chairman of its board of directors, retiring therefrom at the close of 1931. He thenceforth devoted himself more completely to literary work, which, outside of his business, had always been his chief interest.

In the literary field many honors were conferred on Mr. Newton, including the degree of doctor of literature from Temple University, doctor of letters from Haverford and doctor of laws from the University of Pennsylvania.

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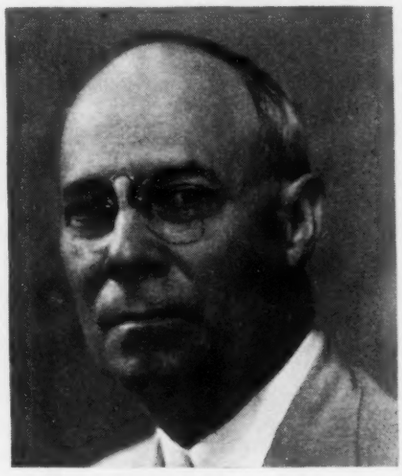
▶ ALBERT L. CLOUGH, 71, an electrical and mechanical engineer widely known in the automotive field, at one time connected with the General Electric Co. at Lynn, Mass., and the Brodie Electric Co. at Manchester, N. H., died in that city on September 21. He was educated at the Massachusetts Institute of Technology and was long active in motor vehicle journalism, as well as in civic and scientific affairs in New Hampshire.

▶ EDWARD HEITMAN, consulting engineer for the Nash-Kelvinator Corp., died September 25 in Montreal, from a heart attack. Mr. Heitman was born in Milwaukee in 1871 and was graduated from Cornell University in 1894. From 1928 to 1938 he served as chief engineer for the Kelvinator division of Nash-Kelvinator Corp. and for the past two years he had been a consulting engineer for the company. Mr. Heitman joined Kelvinator through the Nizer Company when the two organizations merged. Prior to this he served as chief engineer for the Crocker-Wheeler Co. in Canada. His long experience in engineering included service with the Nordberg Co. in Milwaukee, Westinghouse in East Pittsburgh, Stanley Co. at Pittsfield, Mass., and the Submarine Boat Corp. in New Jersey.

John Paul Lucas

John Paul Lucas, merchandise manager of the Duke Power Co., Charlotte, N. C., died at his home in that city on September 28, after a long illness. Mr. Lucas had been connected with the Duke Power Co. and predecessor companies for more than twenty years. He concentrated on public relations work for the Southern Public Utilities Co., predecessor company of Duke



Power, for a number of years, and was made a vice-president of that company.

Mr. Lucas was born on January 25, 1885, and spent most of his life in Charlotte. Before entering the public utility field he had extensive experience in newspaper work. He was elected president of the North Carolina Farmers convention in 1916, serving until 1917, and subsequently was appointed executive secretary of the North Carolina State Food Conservation Commission, still later becoming executive assistant state food administrator under the U. S. Food Administration. He was active in extending rural electrification throughout the territory in which the Duke Power Co. operates and traveled extensively throughout the state, addressing farmers' groups and others on the subject of agricultural advancement and rural development.

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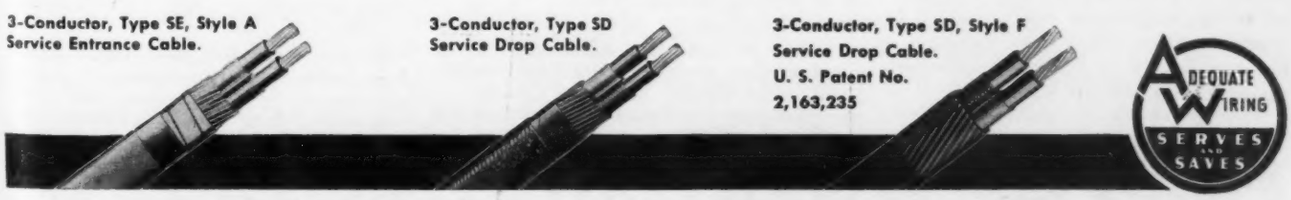
▶ JOHN W. MCIVER, advertising executive, died September 24 at his home in Forest Hills, Long Island, N. Y., following a brief illness. Mr. McIver had been associated as account executive with Maxon, Inc. since 1937. He was formerly advertising and publicity manager of the Edison Lamp Works of the General Electric Co. at Harrison, N.J., and sales promotion manager of the appliance division, merchandise department, General Electric, at Bridgeport, Conn. Mr. McIver had also served as advertising manager of R.C.A. Radiotron and sales manager of Forbes Lithograph. He was born in Sanford, N. C.

ADEQUATE wiring, to be really adequate, must start at the pole and continue throughout the entire building. That's why we stress the importance of using modern service cables.

"Amerite" service entrance and service drop cables — approved by Underwriters' Laboratories — are modern in every respect. Of latest "tamperproof" construction, they are economical and easy to install because of their small dimensions and light weight.

Type SE service drop cable can be installed in direct contact with building walls without insulators or conduit. Two types of tamperproof service drop cables are available. Standard Type SD has the conventional braided covering. Type SD, style F, has the patented "embedded-neutral" finish which prevents the objectionable festooning that often occurs when braided coverings deteriorate under long-continued exposure. Write for our service cable catalog.



AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* — United States Steel Export Company, New York

UNITED STATES STEEL

Crapo
GALVANIZED STEEL
STRAND

RUGGED STRENGTH AND LONG LIFE AT LOW COST

EVERY physical characteristic essential to high strength, long life and trouble-free maintenance is combined —with sound economy—in *Crapo* Galvanized Steel Strand.

The superior tensile properties inherent in steel are used to fullest advantage in this time-proved product. The heavy, ductile, tightly-adherent zinc coatings—applied by the *Crapo* Galvanizing Process—provide lasting protection against corrosion, increase the life of the strand beyond the normal period of replacement. Correctly controlled ductility makes *Crapo* Steel Strand easy to serve. Characteristic ruggedness enables it to withstand the punishment encountered both in construction and in service.

The low first cost and low yearly cost of *Crapo* Galvanized Steel Strand result in important economies to many of America's leading utilities. *Crapo* Galvanized Steel Strand is available in all standard grades and sizes from representative jobbers located in principal distributing centers. Consult the distributor of *Crapo* Galvanized Products near you, or write direct for further information!

Crapo Galvanized Products also include *Crapo* HTC-130 and HTC-80 Steel Conductors (Solid and Stranded 3-Wire), Construction Wire, Tie Wire and Ground Wire.

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

Sales Opportunities

ADA, OHIO—Ohio Power Co., Newark, plans extensions and improvements in power substation at Ada, including installation of additional equipment. Also will modernize and improve distribution system in same area. Proposed to begin work at once.

HIGH POINT, N. C.—City Council is arranging for early resumption of construction of municipal hydroelectric power plant on Yadkin River, near Clemmons, N. C., about 26 miles from city, on which work was begun in spring of 1939 and suspended a few months later. Project will comprise a power dam, 85 feet high; hydro-electric generating station, with three hydraulic-turbine units, each with capacity of 7,000 kw.; switchyard structure and miscellaneous construction. Also, a transmission line from station to city limits, where power substation and switching station will be located, line to consist of two single circuits. Substation will be equipped for rating of 26,250 kva., and will connect with municipal distribution system, which will be extended about 10 miles in different parts of city. Entire project is estimated to cost $6,492,600 and financing in that sum has been arranged through federal loan and grant. Murray & Flood, Inc., 369 Lexington Avenue, New York, N. Y., consulting engineer, has prepared plans for project.

NIAGARA FALLS, N. Y.—Bell Aircraft Corp., 2050 Elmwood Avenue, Buffalo, N. Y., plans installation of transformers and other power substation apparatus, motors and controls, duct lines, switchgear, industrial lighting equipment, conveyors, electric hoists and other equipment in new branch assembling plant near airport at Niagara Falls, where tract of close to 60 acres of land has been acquired. Main production unit will be one-story, about 240,000 square feet of floor space. Work will begin soon. Cost estimated over $1,000,000.

WASHINGTON, D. C.—Bureau of Yards & Docks, Navy Department, Washington, receives bids until October 30 for installation of motor-generating sets and switching equipment, latter consisting of duplex control panels and metalclad switchgear units; also for power and control wiring installation from switching equipment to turbine-alternators, air compressors, motor-generator sets, exciters and station auxiliaries, with motor-starting and controlling apparatus, for new 20,000-kw. power station and 13,000 cu.ft. per minute air compressor plant at navy yard, Pearl Harbor, T. H. (Specifications 9963).

WILLIAMSPORT, PA. — Pennsylvania Power & Light Co., Allentown, Pa., is considering extensions and improvements in steam-electric generating station at Williamsport, including installation of additional equipment.

BANCROFT, IOWA—City Council receives bids until October 24 for extensions and improvements in municipal power plant, including installation of new diesel engine-operated electric generator, switchboard, instruments, enlargement of cooling tower, and other work.

BATESVILLE, ARK.—Arkansas Power & Light Co., Pine Bluff, Ark., has approved plans for new transmission line from Batesville to Norfolk, Ark., including power substation and switching station at latter place. New line will be about 70 miles long and will be constructed by Hoosier Engineering Co., 46 South Fifth Street, Columbus, Ohio. Company also will make extensions in rural lines in district noted. Entire project will cost close to $500,000.

PATERSON, N. J.—Wright Aeronautical Corp., 32 Beckwith Avenue, manufacturer of aircraft engines and parts, plans installation of motors and controls, duct lines, switchgear, conveyors, electric hoists and other equipment in new additions to plants at Paterson, location noted, and Fairlawn, N. J., known as plants Nos. 1 and 3, respectively, totaling close to 250,000 sq.ft. of floor space, in all. Work will be placed under way at once. Cost $1,000,000.

CHICAGO, ILL. — Commonwealth Edison Co. has taken out permit for addition to steam-electric generating plant at 1111 West Cermak Road, 41x104 ft., to be used for expansion in turbine room. Work will include tunnels, intake crib and other facilities, and is estimated to cost about $200,000, exclusive of equipment. Sargent & Lundy, Inc., 140 South Dearborn Street, is consulting engineer.

TEMPE, ARIZ.—Salt River Valley Water Users' Association, Phoenix, Ariz., plans early call for bids for new steam-electric generating station in vicinity of Tempe, for which bond issue of $2,000,000 recently was authorized, with installation to include three turbine-generator units with capacity of 28,000 kw., and accessories, high-pressure boilers, switchyard structure and other facilities. An additional fund of $500,000 also has been voted for transmission lines, power substation units and expansion in electric-operated pumping stations.

ORANGE, TEX.—Consolidated Steel Corp., Ltd., 5700 South Eastern Avenue, Los Angeles, Calif., plans installation of motors and controls, switchgear, regulators, duct lines, exterior and interior industrial lighting facilities, conveyors, electric hoists, electric cranes and other equipment in new shipbuilding plant on 70-acre tract of land on Sabine River, Orange. A power house will be built. Plant will be used for construction of destroyers for Federal Government, which is interested in project and for which Navy Department will provide financing. Cost estimated over $6,500,000.

BREMERTON, WASH.—Public Works Officer, Puget Sound Navy Yard, Bremerton, receives bids until October 16 for combined fire alarm and watchman's recording system, including all instruments, devices, equipment, ducts, wires and accessories, necessary for a complete installation at naval ammunition depot (Specifications 10131).

LUFKIN, TEX.—Southland Paper Mills, Inc., Lufkin, plans installation of motors and controls, switchgear, transformers and accessories, duct lines, regulators, conveyors, electric hoists and other equipment in new addition to newsprint mill, comprising several one and multi-story units for large increased capacity. Work is scheduled to begin soon. Cost reported over $1,500,000.

WASHINGTON, D. C.—Bureau of Supplies and Accounts, Navy Department, Washington, receives bids until October 11 for quantity of electric cable for Portsmouth, N. H., and Mare Island, Calif., navy yards (Schedule 3298); also, until October 15 for 196,700 lineal feet of electric cable for Eastern and Western navy yards (Schedule 3336).

Towers for Floodlighting

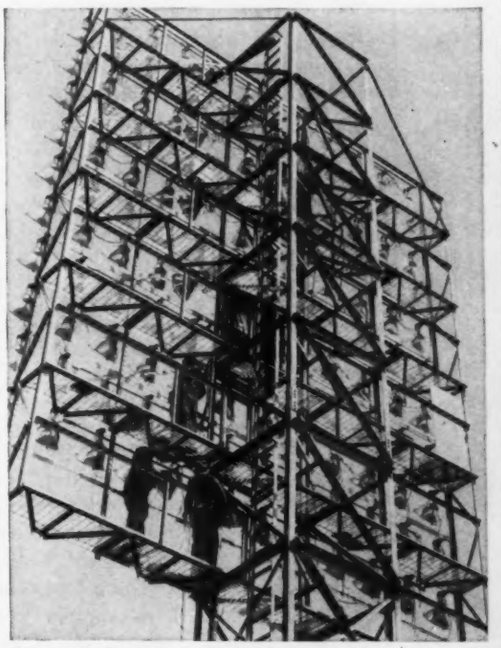
An installation which indicates a tower service adequate for any need

VERSATILITY in the design and erection of towers for floodlighting purposes, from the most simple of standard types to those which call for special consideration and unusual design, has always been a characteristic of American Bridge Company's tower service.

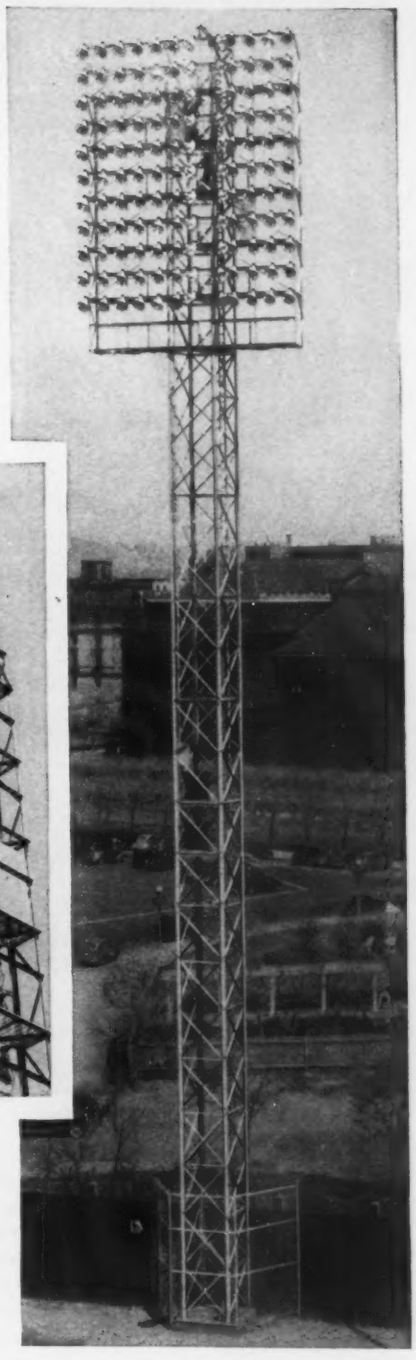
An outstanding installation is that recently made for the Pittsburgh Athletic Company, Forbes Field, Pittsburgh, where the towers are the backbone of a floodlighting system greater in magnitude than any heretofore developed for a baseball park. Clustered some 150 feet above the playing field of the Pittsburgh Pirates, 864 floodlights supported on eight American Bridge-built steel towers turn night into day.

Three of these galvanized towers, located in the outfield, rise the full 150 feet above their concrete foundations. The remaining five are supported by the existing structural steel roof frame of the grandstand, the trusses and columns of which were field-altered and reinforced to withstand the added strain. All eight were designed, fabricated and installed complete, even to the concrete foundations, by American Bridge Company.

However, many installations have much simpler requirements than those described above. For these our service is comparable in every respect. In addition, our Tower Department has developed a series of standard floodlight poles which are promptly available and unusually economical as to materials and installation. Why not refer your requirements to our nearest contracting office?



↑**CLOSE-UP VIEW** of a floodlight cluster. Eleven arms, each 26 feet long, cantilever on either side of the tower shaft to support 132 lights. Each level is framed with a maintenance platform and safety railings. An access ladder extends the full height of each tower.



ONE OF THE 150-FT. outfield floodlight towers carrying a cluster of 132 lights. Lights and electrical equipment were engineered by the Westinghouse Electric & Manufacturing Co. Tower base is protected by galvanized wire fencing manufactured and erected by Cyclone Fence Company, another subsidiary of the United States Steel Corporation. →

AMERICAN BRIDGE COMPANY

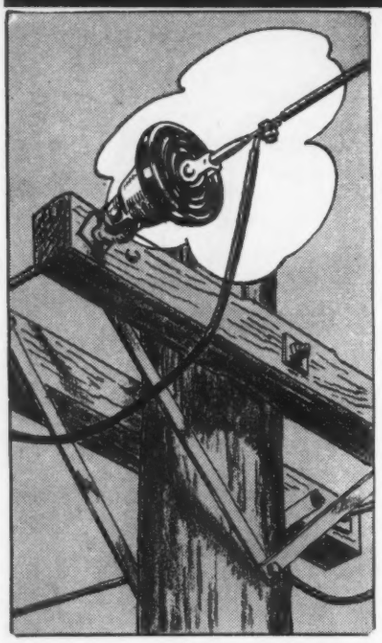
General Offices: Frick Building, Pittsburgh, Pa.

Baltimore · Boston · Chicago · Cincinnati · Cleveland · Denver · Detroit
Duluth · Minneapolis · New York · Philadelphia · St. Louis

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

modernize
YOUR
DISTRIBUTION
PRACTICE—



RELIABLE
STRAIGHTLINE
DEADENDS

Reliable short rigid clevis type deadends make neat installations and are particularly suited to locations where taps are made well out from the pole to provide climbing space and where weatherproof wire is used. They can be fully covered by standard line hose when working hot. Low in cost. Dependable in performance.

Reliable
ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
1143 CARROLL AVENUE · CHICAGO, ILLINOIS

Distribution Outlays Limit Lamp Flicker

[*Continued from page 63*]

to be limited to ½ to ¾ volt to prevent annoyance. A 100-kva. inrush welder would have to be closer than 0.3 of a mile on a 2,300-volt circuit and a 1,000-kva. inrush welder 0.8 of a mile on a 12,500-volt circuit to keep voltage fluctuations within ¾ volt. Another observation to be made is that changing conductor sizes helps very little, for changing from a No. 6 to a No. 4/0 just barely cuts the flicker voltage in half for an eight-fold increase in copper. On the other hand, an increase in voltage is the most beneficial, for the permissible inrush kva. or distance increases as the square of the voltage.

Some welders require enough inrush current to require serious attention to the drop through the substation transformers. In such cases the allowable dip on feeders is decreased by the amount through the substation transformers. In this case the transformer rating is the determining factor, there being very little difference between low- and high-voltage distribution circuits, as shows by Table II. Neither does the connection from line to line instead of line to neutral help any, for it is 15 per cent greater.

Substation Flicker Capacities

A 1,000-kva. distribution substation leaves very little for line drop with a 100-kva. inrush, and 200 kva. or higher gives more than 4 per cent disturbance to all consumers connected to the substation. Even 5,000-kva. substations give a 2 per cent drop at 500-kva. inrush. It is also obvious that a 1,000-kva. inrush and higher must be supplied from a separate bus or from a real stiff subtransmission system. The industry, of course, is equipped with substation capacities much higher than 5,000 kva. in metropolitan areas and the seriousness of the problem is correspondingly reduced in those cases. However, the economies of distribution in general require more and smaller substations than have been the practice in the past and the substation sizes range from 1,000 to 5,000 kva., with 1,500 to 2,400 kva. predominating. Furthermore, the trend to decentralization of industries into non-metropolitan areas makes the supply to these loads a serious problem. It is believed that the smaller substation for general distribution fits in better with these loads than does the large substations because the former makes the high-voltage subtransmission feeders more accessible and such loads can be connected to them instead of to the lower-voltage circuits.

A study of Table II will show that seam welders giving 100-kva. variations with a period between 5 and 10 cycles cannot be supplied to meet a ¾-volt limit on any except the 5,000-kva. substation, and even this is limited to a 200-kva. pulsation. This is an additional reason for supplying industrial loads at the subtransmission voltage, even though such welders are not in use at present. They may be in the future, and if they are the cost of changeover is saved.

Distance From Substation

Looking at the combined transformer and feeder voltage, we find that a 100-kva. inrush will produce a 3 per cent voltage dip on a 2,400-volt, No. 1/0 circuit ¼ mile from a 1,000-kva. substation. If the load were ½ mile from the substation it would require circuit reinforcement at about $2,500, or a change to a 1,500-kva. transformer at an increased cost of $1,200 to $1,500. If the distribution

Table II—Per Cent Drop in Three-Phase Transformers Feeding Single-Phase Welders

(Estimated P.-F. = 0.35)

Kva. Demand During Weld	1,000 Kva.		1,500 Kva.		2,500 Kva.		5,000 Kva.	
	13.8 kv.*	2.4 kv.†	13.8 kv.	2.4 kv.	13.8 kv.	2.4 kv.	13.8 kv.	2.4 kv.
100	2.09	2.23	1.38	1.52	0.82	0.91	0.41	0.38
200	4.18	4.46	2.76	3.04	1.64	1.82	0.82	0.76
300	6.27	6.69	4.14	4.56	2.46	2.73	1.23	1.14
500	10.45	11.15	6.90	7.60	4.10	4.55	2.05	1.90
1,000	20.9	22.3	13.8	15.2	8.2	9.1	4.1	3.8
3,000	62.7	66.9	41.4	45.6	24.6	27.3	12.3	11.4
5,000	.....	.....	69.0	76.0	41.0	45.5	20.5	19.0

* HT-60-1,000-26,000-13,800
† HT-60-1,000-13,800-2,400
} Ratings of 1,000-kva. transformers.
Y-Connection assumed in above tabulation.

circuit were a 4,160-volt, four-wire circuit the load should be connected across the phase wires instead of phase to neutral, though it might entail a change in the consumer's transformers.

Much of the discussion on resistance welders also applies to arc furnaces, although they are not as generally encountered. Their power factor is very much higher on the average, but may be as low as welders on some individual pulsations. They are also a contrast to welders in that they are large energy users and can be operated on a three-phase connection. Furthermore, they produce their most serious fluctuations during the preheating period of a cold furnace and afterward are fairly stable over this much longer period of time.

Base Safety Lighting on Accurate Accident Data

[*Continued from page 57*]

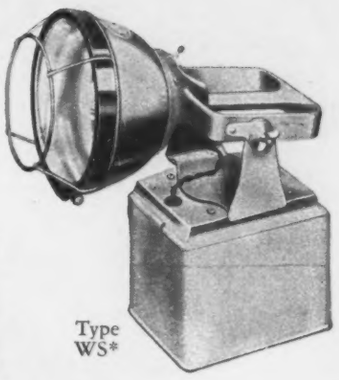
Since locations or sections of highway showing the greatest number of accidents must be given first consideration, it is unnecessary to provide cross-reference files showing type, time, cause, etc. A glance at the map locates danger points and accident histories are secured in a moment from the reports corresponding with the numbers on the back of each tag. Suitable forms are used to classify all information necessary for each study and field check.

Sodium and Signs

Although only a year's record has been compiled, much evidence has been gathered to show the need for more street and highway lighting. An example was the Lakewood Boulevard and South Street intersection in the Los Angeles County rural area near Long Beach. With visibility unlimited and with four-way stop signs, this intersection did not look like a place where accidents should happen. But three years ago they were happening—25 from January 1, 1937, to December 2, 1938, from which one death and 47 injuries resulted. Since all but one of the accidents happened at night, authorities concluded that they were caused by the inability of motorists to see the stop signs. On December 2, 1938, a sodium-vapor light was installed at the intersection, as were warning signs 400 ft. in ad-

"Here's how *I* solved a common maintenance problem—*you can use the same method!*"

"One day not long ago I noticed the report sheets showed our one-man emergency repair crews were taking two or three times longer to make night repairs than they did during the day. Investigation quickly located the trouble. The searchlights given our repairmen weren't good enough. These lights were expensive, too—but they just didn't have the *power* and *convenience* our men needed.


Type WS*

What An Advertisement Told Me

"That same day I saw an advertisement for 'See-A-Mile' MASTER-LIGHTS. '"See-A-Mile"—that's the kind of power you need!' I told myself. The facts on MASTER-LIGHTS looked good to me—and the makers offered a 30-day Free Trial to *prove* performance. So, I sent for a Type T and a Type WS MASTER-LIGHT for each of our repair cars.

The Right Answer

"I found these MASTER-LIGHTS were all I'd hoped for! The roof-mounted Type T, shooting a brilliant 250,000 candle power beam for more than a mile, was just exactly what our driver-repairmen needed. Its power let them find broken insulators quickly at night—even in fog, rain, or snow! The *convenience* of roof-mounting with one-hand instant control let them drive and look for trouble spots at the same time.

Another Helpful Light

"The Type WS MASTER-LIGHT proved equally handy when a portable hand searchlight was needed. You see, the WS weighs only 12 pounds, yet it also has a 250,000 candle power beam more than a mile in range. Furthermore, it has a 2-Filament Bulb which gives 8 hours continous high-beam light, or 24 hours continuous service light, on one battery charge." (Naturally, a charge lasts much longer in normal intermittent use).

The above is fictionalized, but typical of customer reactions.

How MASTER-LIGHTS Can Help You!

Over 500 U. S. Public Utilities now use MASTER-LIGHTS! You, too, will find that MASTER-LIGHTS' *high power* and *convenience* increase the efficiency of your emergency crews. Increased efficiency means SAVINGS for your Company. In fact, in a short time your MASTER-LIGHTS may *more than pay for themselves* in just *one* emergency. And, their rugged, durable construction cuts replacement costs to a minimum.

The MASTER-LIGHTS You Need

Every one of your repair cars should be equipped with at least one Type T and one Type WS MASTER-LIGHT. Type T (right) and Type WS (above) *both* have POWER. You can read a newspaper by either's light a mile away!

Both are convenient to use, too! The WS weighs only 12 perfectly balanced pounds. The T points instantly in any direction as easily as you point your finger—yet a special friction device locks it any position so the roughest road can't shake it loose! And—these MASTER-LIGHTS are built to *last*, with rust and weather-proof construction.

To increase the night-time efficiency of your emergency repair crews, you need both these MASTER-LIGHTS!

TRY MASTER-LIGHTS NOW—*FREE*

Now, let us ship you as many Type T and WS MASTER-LIGHTS as you wish on 30-day Free Trial! Don't take *our* word that these MASTER-LIGHTS will help your men. *Prove it yourself*—at our risk! Could we be fairer than that?

Type T*

* List prices, Type T, $19.50; WS, $45.00; F.O.B. Cambridge, subject to change without notice. *However, your Public Utilities Company is entitled to straight manufacturer's price—full discount from list.*

CARPENTER MFG. CO., 212 Sidney St., Cambridge, Mass.

CLIP AND MAIL THIS COUPON NOW!

CARPENTER MFG. CO., 212 Sidney St., Cambridge, Mass.

Send me at once, without obligation to myself or my Company, the numbers of Type T and Type WS MASTER-LIGHTS noted below for 30-Day Free Trial. Also send me a free copy of your Folder describing 13 more MASTER-LIGHTS that will help me.

.....Type T MASTER-LIGHTS .....Type WS MASTER-LIGHTS

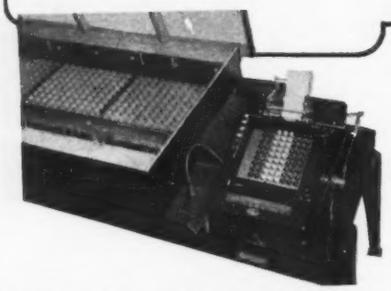
Name and Title.....

Company .....

Street and Number.....

City and State.....

From your existing records to a detailed analysis in a single operation



The One-Step Method of Bill Analysis . . .

Made possible through the use of our special Bill Frequency Analyser machines illustrated above. These machines were designed and built by us for service to the Public Utility field.

Customer Usage Data - At lower cost - - - - - - Done in less time

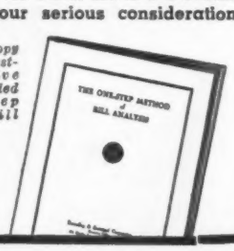
Our method is the direct and practical answer in making complete and accurate consumption analyses. Skilled operators working from your billing register, or other customary record, produce in one operation an accurate breakdown of your consumption figures.

●

The standard report produced shows 1—The kw. hrs. per bill; 2—The number of bills; 3—Consumption in kw hrs; 4—Cumulative number of bills; 5—Cumulative Consumption in kw hrs.

If your problem calls for complete Customer Usage Data at Lower Cost in Less Time, the R & S Method merits your serious consideration.

Send for your copy of a brief, interesting, descriptive booklet entitled "The One-Step Method of Bill Analysis."



RECORDING & STATISTICAL CORPORATION

Utilities Division

102 MAIDEN LANE, N. Y.

BOSTON • CHICAGO • DETROIT

MONTREAL • TORONTO

vance of the stop signs. Since that time only two accidents have occurred at the intersection.

Other locations in Los Angeles County with high night accident rates have been protected with lighting. In the near future it is hoped that this scientific accident-recording system will prove definitely that lighting at these danger points was the correct solution.

Rack Co-ordinates Relay Selectivity

[*Continued from page 56*]

the directional relay on Fdr. 9572 at Eastchester will be selective with the directional relay on Fdr. 9903 at Anaconda, as there will be 45 minus 17 or 28 cycles clearance. The selectivity with the overcurrent relay on Fdr. 9903 at Dunwoodie and with the directional relay on the 4-kv. side of bank No. 3 at Eastchester will be 57 minus 17 or 40 cycles and 58 minus 17 or 41 cycles respectively.

Single-Phase Fault

In the example just given a three-phase fault was considered and the corresponding currents were marked on the current scales. If a single-phase-to-ground fault is considered, this method is equally applicable, the markers being moved to the correct positions on the current scales to indicate the amount of current flowing over the grounded phase.

Some feeders may be protected by overcurrent ground relays in addition to the straight overcurrent relays, in order to secure greater selectivity on ground faults. The setting on ground relays is usually faster than on overcurrent relays, and on the current scale for ground relays it must be remembered that the value of current to which the marker will be set is that for residual ground current flowing over that feeder, or through that particular ground relay. Ground relays will operate only on residual ground current.

By changing the position or order of the current scales in the rack and by inserting a new selectivity scale in the slot at the bottom of the rack the selectivity of any other faulted feeder at that substation may be found.

The rack method of determining relay selectivity will eliminate several errors that very often occur when using the former method of relay fault curves. When replotting the same relay curve several times it is highly probable that the curves will not all pass through exactly the same points. Under the rack method, however, only one current scale is used for a certain relay, and no matter how many times this one relay current scale may be used, corresponding values of currents and tripping times will always remain the same. Also when using relay curves, the fact that these curves may cross each other leads to confusion in marking the proper amount of current on the proper relay curve. This confusion will not result when using the rack method, as the current scales are separated from each other and the current value of each one is indicated individually by its own marker.

A real saving in time and labor when using the rack method of determining relay selectivity will be appreciated on studies involving system power swing. Assuming the capacity of the rack is twenty current scales at one time, the twenty fastest relay settings on the system can be selected and the corresponding current scales inserted in the rack. By moving the current markers on these scales according to various conditions of system operation during power swing, selectivity scales can be compiled for each condition. Thus, for every condition of power swing considered, the drawing of twenty relay curves will be eliminated.

More Power for the Salesman

[*Continued from page 59*]

It might be pointed out that these small jobs are not all in the plants of small customers. In fact, most of your larger companies are prospects for hundreds of little items like babbit pots, switchgear heaters, soldering irons, etc. Ordinarily you can't afford to spend time promoting these loads. You have bigger fish to fry. Often times the fellows you deal with wouldn't even be interested. I heard of one case where the mill superintendent didn't know his crane cabs were heated with electric heaters until he read about it in an ad!

The chief criticism leveled against industrial power advertising is that it seldom produces results which are

directly traceable. The reason for this has already been shown. It is only one of many subtle influences at work on the customer's mind.

Ask the average individual if he is influenced by advertising and he will give you an emphatic No! But look at the sales figures for any every-day item such as toothpaste, soap or automobiles and you will see that 130,000,000 people show a definite preference for the nationally advertised brands.

Creates Acceptance

The fact is that outside of the specialty field, which is generally in the hands of high-pressure artists, nobody is sold anything. Most people are merely influenced to the point where they want to buy. I recently heard a power man tell how he sold a 300-kw. lighting load to a large industrial customer for night protection against plant sabotage. Actually, the power man did a lot of work to get this load. He arranged for a complete layout of plans and specifications, secured bids from several manufacturers on equipment, estimated power requirements and operating costs, and stressed the need for and benefits of the proposed installation, and finally got the order. But if you were to ask the customer if this man sold them on the installation, the customer would laugh at you. If he could remember all the things which influenced him to want to buy, they might include his experience during the last World War; Hitler's march into Belgium; several trade paper articles on factory protection; an insurance company bulletin; several lighting equipment manufacturers' ads in trade papers; a four-page folder from his power company; an article in *Timely Ideas;* a letter from the U. S. War Department and, finally, the efforts of the power man. So you see nobody or no single influence can claim all the credit for that order. Yet if any one of these influences had been lacking it is likely the customer would not have wanted to buy or at least might have delayed his purchase.

Power men who have worked with the help of intensive advertising aid are quick to proclaim its value. One industrial sales manager asked his staff to estimate the part which advertising played in getting each individual job closed during a six-week light-

Plant at Irvington and Views of Electrical Testing, Research—Development and Chemical Laboratories.

INSULATING HEADQUARTERS . . . SINCE 1905

Pioneering thirty-five years ago in the development and manufacture of improved varnished cambrics, Irvington has steadily introduced new types of flexible varnished insulations to become the largest manufacturer of this class of product.

Steadfast insistence on quality, combined with progressive laboratory development and proper laboratory control, has always been universally recognized as a part of all Irvington operations—and consistently reflected in all Irvington products.

With a modern, fireproof plant in New Jersey equipped with the most up-to-date machinery and containing extensive Laboratory facilities — and with another plant in Canada — three separate Company Divisions now offer sixteen different insulating products in a wide range of grades, sizes and characteristics.

With production capacity sufficient to fill all normal and emergency needs, and with stocks available for immediate deliveries, Irvington welcomes all inquiries and offers an immediate solution to insulating problems.

IRVINGTON ELECTRICAL INSULATIONS

Varnished Cambric Cable-Cloth.
Varnished Cambric for general insulation.
Varnished Fiberglas.
Varnished Duck.
Varnished Silk.
Varnished Paper.
HARVEL Protective Paints, Coatings and Finishing Enamels.
HARVEL, Oil Stop.
IRV-O-VOLT Varnished Inside-and-Out Tubing and Sleeving.
IRV-O-LITE Extruded Plastic Insulating Tubing.
IRV-O-SLOT Composite Slot Insulation.
IRVINGTON and HARVEL Insulating Varnishes.
CARDOLITE Coil Sealing Insulation.

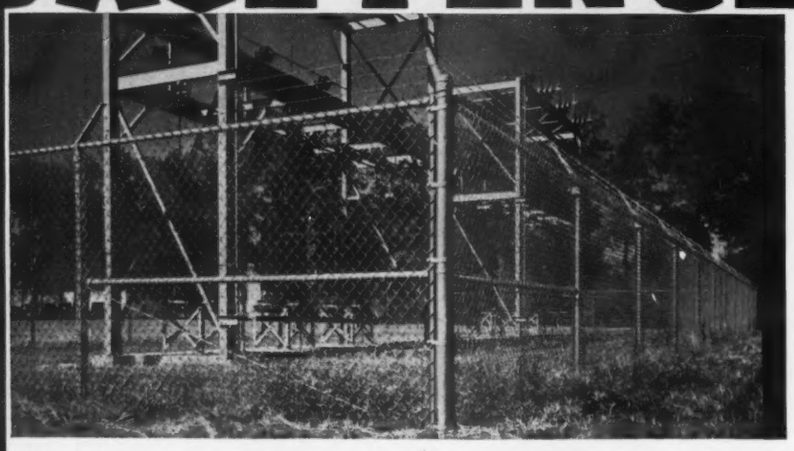
IRVINGTON VARNISH & INSULATOR CO.

IRVINGTON, NEW JERSEY, U. S. A.

PLANTS AT IRVINGTON, N. J. and HAMILTON, CANADA

Representatives in 20 Principal Cities

PAGE FENCE



COME ON—BE A METALLURGIST!

● When you talk to a Page engineer you'll learn much about fence metals: heavily galvanized copper-bearing steel, Armco ingot iron, Alcoa aluminum, Allegheny stainless steel. Only Page makes fence of all these reputable metals. He will consult with you as to the one best suited to your needs. And he will tell you about Page's exclusive winged channel posts. You'll also learn about superior fence erection, for he is one of 97 factory-trained, responsible local distributors. Write PAGE FENCE ASSOCIATION, Bridgeport, Conn., Atlanta, Chicago, New York, Pittsburgh or San Francisco for Page Fence Book and name of nearest qualified member of the association.

A PRODUCT OF PAGE STEEL & WIRE DIVISION—AMERICAN CHAIN & CABLE COMPANY, INC.

America's First Wire Fence — Since 1883

ANNOUNCING!

A NEW GREENLEE TUBE BENDER

For ¼ to ¾-Inch Tubing

The new Greenlee No. 763 Tube Bender was designed to bend steel, copper, brass, and aluminum tubing without kinking and flattening of the tube, a trouble usually encountered in tube bending. Six sizes of benders are available for bending ¼", 5/16", ⅜", ½", ⅝", and ¾" O.D tubing. The tube is held tight to prevent slipping and the bending is done by rolling action, rather than sliding, which minimizes friction, leaving the finish of the tube unmarred.

Send for Bender Booklet

This new Tube Bender is but one of a complete line of Greenlee Benders for conduit, pipe, or tubing from ¼ to 4½-inch size. Small hand benders for tubing or powerful hydraulic benders for conduit, pipe, and busbars are all described in the new Greenlee Bender Booklet. Write for your copy today!

GREENLEE TOOL CO., 1705 Columbia Ave., ROCKFORD, ILL.

ing promotion activity. Advertising was credited with influencing the sale in 60 of the 93 jobs closed. Yet, special lighting advertising sent out during this activity had brought in only fourteen direct inquiries and half of these were not closed. Advertising does influence the sale in many cases where it does not get a direct response.

Produces Inquiries

There are many cases, however, in which advertising does produce definite inquiries. One industrial manager cites nine lighting jobs with loads totaling 47 kw. which were closed by his staff as a result of postcard inquiries returned from advertising pieces. He also mentions the sale of a 56-kva. air-conditioning job which he first learned about through an inquiry in response to advertising.

Another reports that "there have been many times when an electric heating proposal from us was much more kindly received because of the groundwork laid by our long series of mailings on this subject." He also mentions two specific inquiries which came as a direct result of electric heat advertising. One of these, a 50-kw. infra-red installation, he expects to close soon.

Here is a very interesting example as reported by another power sales executive: "I could name a number of jobs which advertising has helped us sell, but I would like to tell about one case where advertising sold an idea that on the face of it looked too preposterous for a power man even to suggest.

"One day last winter one of our men got a call from the manager of a coal cleaning plant who wanted some information on electric heat. When the power man saw what the customer had in mind, he almost fell over. The fellow wanted to heat a 10,000-gallon tank of wash water to keep it from freezing. Much to his surprise, when he estimated the requirements, the power man discovered that it was a beautiful application, because it really took only a few kilowatts and it eliminated the need for operating a boiler plant that would have cost the customer $600 a month. The customer had gotten the idea from something he read in one of our publications. Since then the power man has closed three other jobs for electric heat around this same mine."

Allot Rural Funds; Contracts Awarded

Allotments for rural electrification recently announced by the Rural Electrification Administration brought allotments made by REA since it was established in 1935 to $316,737,114. Among the recent allotments are the following:

ARKANSAS—Southwest Arkansas Electric Co-operative Corp., Texarkana, Calvin M. Hervey, Jr., supt., $240,000 to build 154 miles of line, 403 members in Pike and Clark Counties, plus 18 Cinnabar Mines.

COLORADO—Southeast Colorado Power Assn., La Junta, E. G. Rash, supt., $40,000 to finance construction of 22 miles of transmission line.

MARYLAND — Southern Maryland Tri-County Co-operative Association, Inc., La Plata, Forrest Coakley, supt., $84,000, of which $12,000 will be used for construction of an office building, garage and storage facilities, the remaining $72,000 to build 50 miles of line, 165 members in Charles, St. Marys and Prince Georges Counties.

MISSOURI—Barton County Electric Co-operative, Lamar, Mo., Claypool Daugherty, supt., $88,000 to build 120 miles of line, 270 members in Vernon, Barton and Jasper Counties.

NORTH CAROLINA — Caldwell Mutual Corp., Lenoir, G. F. Messick, supt., $232,000 to build 178 miles of line, 753 members in Watauga, Ashe, Alleghany and Caldwell Counties.

OKLAHOMA — Cotton Electric Co-operative, Walters, C. W. Cox, supt., $159,000 to build 217 miles of line, 513 members in Cotton, Comanche, Stephens, Jefferson, Grady and Tillman Counties.

TEXAS—McCulloch County Rural Electric Co-operative, Inc., Brady, Will Kennerly, supt., $173,000 to build 276 miles of line, 592 members in Brown, San Saba, Concho, McCulloch, Menard and Coleman Counties.

VIRGINIA — Shenandoah Valley Electric Co-operative, Box 115, Dayton, L. E. Long, supt., $103,000 to build 80 miles of line, 259 members in Shenandoah, Rockingham and Augusta Counties.

GEORGIA—Coastal Electric Membership Corp., Darien, Roger P. Youmans, president, $132,000 to build 142 miles of line, 613 members in McIntosh, Liberty and Bryan Counties.

IOWA — Allamakee-Clayton Electric Co-operative, Inc., Postville, Kermit M. James, supt., $260,000 to build 300 miles of line, 860 members in Allamakee, Clayton and Fayette Counties.

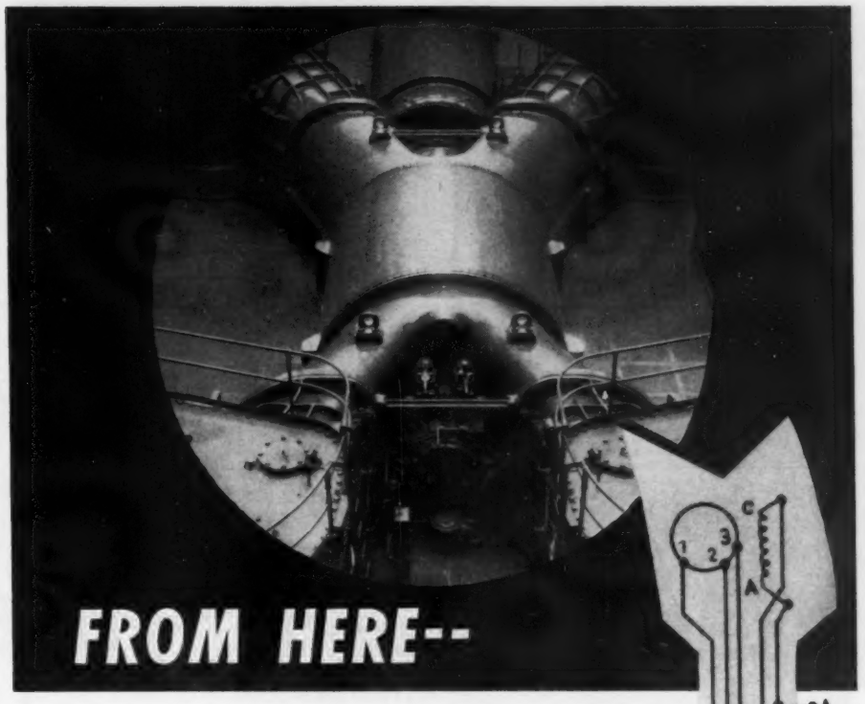
MINNESOTA—Todd-Wadena Power and Light Co-operative Assn., Wadena, Earl Schultz, president, $237,000 to build 282 miles of line, 693 members in Todd and Wadena Counties.

SOUTH CAROLINA—Lynches River Electric Co-operative, Inc., Pageland, W. S. Cauthen, supt., $181,000 to build 228 miles of line, 923 members in Chesterfield, Lancaster and Kershaw Counties.

WISCONSIN—Lafayette Electric Co-operative, Darlington, Wis., Edward J. Paska, supt., $98,000 to build 103 miles of line, 279 members in Lafayette, Green and Iowa Counties.

Construction contracts approved between August 24 and September 17 included the following:

ARKANSAS—Clay County Electric Co-operative Corp., Corning, Willie C. French,



VIA

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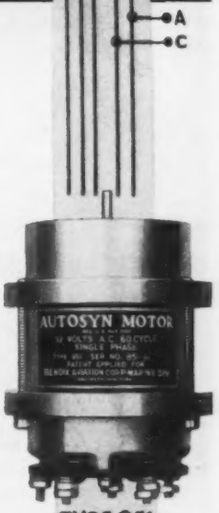
AUTOSYN

SELF-SYNCHRONIZING

SIGNALING UNITS

THE circuit diagram in the arrow shows how simply a pair of Bendix-Cory Autosyns transmit instrument readings to remote points. Pressure, station load, r.p.m., position, rate-of-flow, count, dimension, liquid level—almost any measure—may thus be read at a distance in one or several places. Several sizes and types. Type 851 (shown) produces 2.5 inch-ounces of torque at 90° angular displacement—safe continuous operating torque 1.1 inch-ounces. Weight 15.3 ozs. Dimensions 2⅜" x 3-15/32". Other Autosyns operate within an accuracy range of 1° + or — (½° + or — on special order).



One Autosyn Transmitter can actuate several variously located receivers for remote instrument readings.

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(In Rounds, Flats and Squares)
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ROME CABLE CORP. ROME, N.Y.
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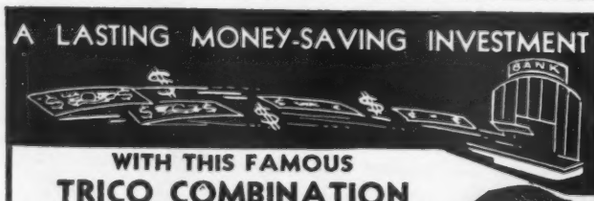

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supt., and Ray W. Chanaberry, Inc., Realty Bldg., Louisville, Ky., engineer, contract to L. O. Brayton & Co., Dyersburg, Tenn., for building 185 miles of line, 371 members; bid $84,844.

COLORADO—LaPlata Electric Assn., Inc., Durango, Glenn Skewes, supt., and Rocky Mountain Engineering Co., 1441 Wilton St., Denver, Colo., engineer, contract to the Sandberg and Johnston Construction Co., Hampton, Iowa, for building 180 miles of line, 373 members; bid $116,351.

GEORGIA—Douglas County Electric Membership Corp., Douglasville, J. H. Abercrombie, supt., and the J. B. McCrary Engineering Corp., Marietta Street Bldg., Atlanta, Ga., engineer, contract to Roy Richards, Carrollton, Ga., 108 miles of line, 294 members; bid $64,934.

IOWA—Howard County Electric Co-operative, Cresco, E. G. Skarshoug, supt., and K. R. Brown, Des Moines, Iowa, engineer, contract to Acme Construction Co., St. Paul, Minn., for building 357 miles of line, 690 members; bid, $206,105.

KANSAS — Norton-Decatur Co-operative Electric Co., Inc., Norton, Fremont Sleffel, supt., and Raymond H. Reed & Co., Case Bldg., Abilene, Tex., engineer, contract to Crawford Electric Co., North Platte, Neb., for building 103 miles of line, 154 members; bid, $57,809.

NORTH CAROLINA — Cornelius Mutual Corp., Cornelius, B. O. Vannert, Commercial Bank Bldg., Charlotte, N. C., engineer, contract to the Miller-Baxter Co., Inc., Indianapolis, Ind., for building 228 miles of line, 700 members; bid, $148,363.

OHIO—Guernsey-Muskingum Electric Co-operative, Inc., New Concord, H. B. Smith, supt., and Putnam and Woolpert, 132 N. Main St., Dayton, Ohio, engineer, contract to D and W Construction Co., Columbus, Ohio, for building 235 miles of line, 703 members; bid $160,115.

OKLAHOMA—Cimarron Electric Co-operative, Kingfisher, Roy Boecher, supt., and S. B. Wadley, Kingfisher, engineer, contract to the Stovall Construction Co., West Plains, Mo., for building 154 miles of line, 230 members; bid, $71,413.

PENNSYLVANIA—Sullivan County Rural Electric Co-operative Assn., Forksville, Wesley S. Thomas, supt., and Gibbs and Hill, Pennsylvania Station, New York, engineer, contract to C. M. Davis and Sons, Harrisburg, Pa., for building 67 miles of line, 166 members; bid, $46,522.

SOUTH CAROLINA—Black River Electric Co-operative, Inc., Sumter, S. C., J. D. Heriot, supt., and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to W. H. Herne, Jr., Sumter, S. C., for building 295 miles of line, 635 members; bid, $163,499.

TENNESSEE—Volunteer Electric Co-operative, Decatur, W. S. Bates, manager, and T. R. Hunnicutt, 100 E. Burwell Av., Knoxville, Tenn., engineer, contract to W. A. Smith, Hepburn Bldg., Louisville, Ky., for building 106 miles of line, 230 members; bid $84,279.

TEXAS—Gate City Electric Co-operative, Inc., Childress, Carl C. Cox, 619 Oliver Eakle Bldg., Amarillo, Tex., engineer, contract to Richards and Mullinix, Oklahoma City, Okla., for building 274 miles of line, 576 members; bid $138,575.

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Will Ask Voters' Approval

The city of Soap Lake, Wash., at its next election will vote on the proposition to purchase the Soap Lake Utilities Co. at a cost of $40,000.

LETTERS TO THE EDITOR

Bridging the Gap Between Men and Management

To the Editor of ELECTRICAL WORLD:

Your editorial headed "Management and Men" is the best I have read on this frequently overlooked phase of power production, that of the relationship between the "company" and the plant personnel.

Perhaps I can be excused for outlining my own experience during the past twelve years, which may appear egotistical but is in reality merely an outline of actual facts.

At 28 I was appointed chief engineer of a large industrial plant. At the conference that resulted in my appointment I was informed that I had been selected to clean up a terrible mess, that the power plant was in a dirty and dilapidated condition and that failure of some part of the plant was a weekly occurrence. My informant was a general manager whose knowledge of electric power production from coal was decidedly limited; a man who had been led to believe that 90 per cent of all plant failures were inevitable, and were part of the price one has to pay for electric power.

On taking over the control of this plant I found that I was up against a real problem. Overhauling every piece of equipment in the plant was not the major problem; overhauling the attitude of the entire personnel was the big job.

For about two or three months I studied each individual, learning the weak and strong points of each and concluding with a gradual but complete reorganization. I then decided to overhaul one of the largest pieces of equipment. This was done by our own staff and I worked with them daily. In this manner I gained their confidence, they began to realize that I knew my job and that I was determined to make the plant better for all concerned, the men, the company and myself.

At this stage I induced the general manager to visit the plant (he had not seen inside the walls for several years). I had a long conversation with him, outlining my hopes and plans. After diplomatically convincing him that if these plans were approved power production costs would be cut 18 per cent, he agreed to give me a free hand.

There is hardly a week goes by now that he does not drop in to show some friend around, his visible pride has inspired dormant enthusiasm and he is familiar with every piece of equipment.

The attitude of the personnel toward the company underwent an even greater change than the appearance of the plant and I have gained more from self-satisfaction than any salary increases that I have received.

It may have taken me a long time to say it, but here it is: The gap between management and its greatest asset (its employees) can be bridged by any executive capable of constructing the bridge.

A. E. MCGRUER

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Common-Sense Viewpoint

To the Editor of ELECTRICAL WORLD:

Your good editorial in the August 10 issue of ELECTRICAL WORLD (Engineering Personalities) is not only very appropriate but it suggests a point of view which I believe should be kept before all our electrical engineers, including those of the best and largest manufacturing organizations.

Engineers have a tendency to become more complex in their solutions in many cases where simplicity is much the best answer. They forget that the maximum ultimate benefit to be obtained is more to be desired than a theoretical solution involving countless complications. In other words, the practical aspects of first investment, construction, operations and the possibilities of defect entering into each of the various elements should be weighed against any possible gain which might theoretically be obtained by some trick complication of circuits.

Your editorial points out the fact that our modern installations must have back of them great engineers and you also indicate that there is a definite need for engineers who are not satisfied with things as they are. My utility and other experience inclines me to constructive criticism of past engineering with a view to better engineering in the future. Perhaps this places me in that class of engineers who are not satisfied with things as they are and who thus do not enjoy great popularity with commercial organizations who think there is more profit in standardization on past designs than there is in better engineering solutions.

It appears to the writer that what this country needs is not the "good five-cent cigar" but a good common-sense viewpoint of all problems, whether they be electrical, mechanical, chemical, business, social or whatnot, and that the solution adopted should be that which is based on very sound fundamentals shorn of false impressions or propaganda supporting business, political, labor or social rackets.

J. C. HOBBS, Vice-President in Charge of Manufacturing for the Diamond Alkali Company

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FOR MOST ANY ELECTRICAL CONNECTION you can't beat Sil-Fos BRAZING!
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ATTENTION MANUFACTURERS!

Forms for the 1941 edition of Electrical Buyers Reference close October 15th.

This year, EBR offers manufacturers a particularly productive channel of approach to the 30,000 key electrical men who use it. If you don't have full information already, we'll be glad to rush it to you.

WHAT EBR OFFERS ITS ADVERTISERS

- In 1940, there were two editions of Electrical Buyers Reference. For 1941, these have been combined into one enlarged volume which will be doubly useful to electrical buyers, doubly effective for manufacturers' "briefalogs".
- The 1941 edition will have a minimum distribution to thirty thousand key men in the electrical industry.
- These 30,000 men are the important buying factors among electrical contractors, large industrial plants, electrical utilities, electrical wholesalers, mines and railroads, electrical manufacturers, and electrical consultants. They are the men who specify the make and type of equipment used on electrical jobs.
- Electrical Buyers Reference offers these men thoroughly indexed and hence readily available information on the widest variety of products of over 3,000 manufacturers, compressed into a single, desk-size volume.
- To the manufacturer of electrical and allied equipment, this 1941 Edition offers a direct avenue of approach to these 30,000 active buyers. No other reference volume covers even a fraction of these men as completely and effectively.
- EBR further offers manufacturers the opportunity to deliver the impact of their sales messages at the psychological moment when the prospective buyer is most receptive, when he is not only interested in buying, but when he is about to buy.

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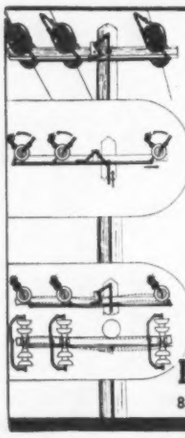

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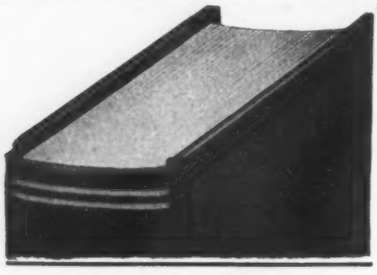

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110-Kv. Cable Tie for High Continuity Service

[*Continued from page 48*]

volts was considered the maximum allowable, it was necessary to use insulating rings in the sheath of each joint to divide the cable into numerous sections. In sections of more than 430 ft. the sheaths were grounded through a bonding transformer or reactance which halves the sheath current. In sections less than 430 ft. the sheaths were connected directly to the drainage cable. The maximum section length is about 690 ft. On the long submarine section it was necessary to run with the short-circuited sheath, thereby setting up high circulating currents in the sheath and armor, which, obviously, would cause heating. The armor and sheath of each cable have been grounded through a common connection at each edge of the river crossing.

In locations where electrolysis presents no problem the sheaths of power cables can be directly connected to ground, but in this installation, where trolley service is extensive, it was necessary to connect the sheaths to an insulated conductor and carry the latter to ground at predetermined points where no bad effects could result from electrolysis. For this purpose a No. 4/0 insulated conductor was installed, paralleling the power cable, and this is used for drainage.

The submarine section has a lead sheath 0.149 in. thick, covered with jute, armor and jute. Each cable has a 1,000,000-circ.mil copper conductor, which reduces internal heat production. In connection with the spare conductor laid in the river crossing a special oil reservoir was provided to maintain oil pressure at all times. This fourth conductor will be held in reserve against emergency and will not be alternated in service with the other phase conductors of the submarine run. The cables are laid about 2 ft. apart and 6 ft. below the river bed.

Stop Joints

Each stop joint represents a considerable investment, and probably the chance of a failure which might cause damage is greater in these manholes. Fire protection was therefore provided in the shape of CO_2 containers equipped with temperature control release nozzles. To protect men working in manholes from acci-

dental gas discharges a lifting handle was devised which normally obstructs the manhole entrance and which must be removed before any one can enter. When this is lifted and laid upon the ground near the manhole it shortens a mechanical connection with the gas discharge mechanism in such a way that the valve equipment cannot function until the lifting handle is replaced and the cover restored to its original position.

The cable jointing work required 84 normal and twelve stop joints, with six potheads. As men versed in this procedure are not ordinarily attached to the operating company's staff, a school was set up under the cable manufacturer's direction to train men for about two weeks to handle the task. When the splicing started two crews of three gangs each were organized on a 24-hour basis, enabling the work to be carried on continuously on a five-day week. Each crew consisted of a first-class splicer, a second-class splicer, helper and an inspector. It required about 20 hours to make a normal joint, 40 hours for a stop joint and about 60 hours for a pothead. The work extended from June 16 to October 2. Special tents were erected over manholes to protect against inclement weather and tents also guarded the potheads. A special truck with equipment for evacuating joints and treating the oil was added as a construction necessity and remains as a part of the service equipment. This truck carries the major part of the special equipment required in the maintenance of the oil-filled cable.

Control Cable

The control cable paralleling the power cable is used to operate a signal in the dispatching office in case of abnormal oil pressure in any of the reservoirs. Three conductors were also connected to current and potential devices in the Admiral Street potheads and arranged to signal the dispatcher if fault current should flow from the overhead transmission line into the cable.

The entire cable was subjected to a short-circuit heat run after installation and the temperature rise was within the guarantee of 30 deg. C. above a 20-deg. ambient. The run lasted about nine hours, when the temperature rise ceased. The main purpose of this test was to check the functioning of the oil reservoir and supply system. After completion of the heat run and a potential test the circuit was placed in operation October 2, and to date the only trouble experienced of any consequence has been one small oil leak which was detected by a gradual falling off in pressure in one of the reservoirs.

BOOK REVIEWS

Troubles of Electrical Equipment

By H. E. Stafford. Second Edition. McGraw-Hill Book Co., New York, N. Y. 373 pages, illustrated. Price, $3.

The 1937 edition (reviewed in ELECTRICAL WORLD February 23, 1937) has been enlarged by the addition of a new chapter on determination and location of cable faults, in which emphasis is placed on loop, bridge and tone-test methods for both power and communication cables. Numerical solutions are numerous.

•

Television: The Electronics of Image Transmission

By V. K. Zworykin and G. A. Morton. Published by John Wiley & Sons, 440 Fourth Ave., New York, N. Y. 646 pages, illustrated. Price, $6.

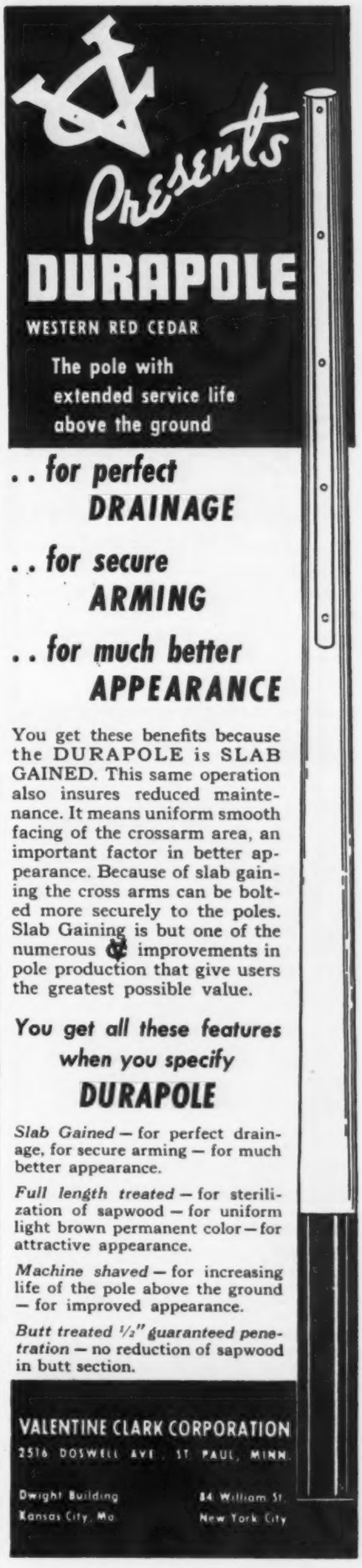
If, as and when television is authorized to parallel broadcasting of sound and outdo it as a consumer of electric energy in the homes, there will be a wide demand among electrical engineers for knowledge of the technology of image transmission. This book by leading engineers of the R.C.A. electronics research staff starts with thermionic emission and luminescence, proceeds through the theory of video electronic equipment and ends with a detailing of the equipment in the RCA-NBC project now in program functioning. It analyzes the obstacles to acceptable image registration, propagation and reception, with minor emphasis on the historical attempts to establish television. Treatment is mathematical and the structural set-up follows the customary textbook pattern without detracting from its usefulness to general engineers reseasonably versed in electronics.

•

Chamber's Technical Dictionary

Edited by C. F. Tweney and L. E. C. Hughes. Published by The Macmillan Company, New York. 960 pages. Price, $5.

Some 29 specialists in British science and engineering have here contributed definitions of better than 36,000 terms in those fields as well as in manufacturing, construction and mechanics trades. Electrical terms are well represented among the 120 categories recognized in the classification. That the entries are up to the minute is attested by the inclusion of terms of such modern practices as "cubicle-type switchboard" and "Deïon circuit breaker." This is a rigorously technical dictionary and should not be mistaken as giving popular definitions of scientific words for the lay user.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. . for perfect DRAINAGE
. . for secure ARMING
. . for much better APPEARANCE
You get these benefits because the DURAPOLE is SLAB GAINED. This same operation also insures reduced maintenance. It means uniform smooth facing of the crossarm area, an important factor in better appearance. Because of slab gaining the cross arms can be bolted more securely to the poles. Slab Gaining is but one of the numerous improvements in pole production that give users the greatest possible value.
You get all these features when you specify
DURAPOLE
Slab Gained — for perfect drainage, for secure arming — for much better appearance.
Full length treated — for sterilization of sapwood — for uniform light brown permanent color — for attractive appearance.
Machine shaved — for increasing life of the pole above the ground — for improved appearance.
Butt treated ½" guaranteed penetration — no reduction of sapwood in butt section.
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EVERSTICK ANCHORS...

Speed and ease of installation are features that crews and engineers appreciate in Everstick Anchors. Nut housing locks, anchor firmly on rod—entire unit is installed and expanded in a minimum of time. Write for new bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

Reduce Ground Resistance for Better Service

[*Continued from page 64*]

In addition to the grounds at individual transformers and along the lines with overhead ground wires special attention is given to the substations. From the illustrations it can be seen that careful tests and revamping have reduced station grounds from 400 ohms to practically zero, from 200 to a value of 10 to 13 ohms, from 450 ohms in another case to 8 to 14 ohms. One station with three 500-kva transformers showed 1,000 ohms in 1934 when it had 15-ft. lengths of 1½-in. galvanized pipe for grounds. The new rods were Copperweld driven to 19-ft. depth; three 7-ft. rods were sweated together into a single length by means of copper tube sleeves. A strange phenomenon encountered in this instance for well over two weeks was a vigorous discharge of air or gas at sufficient pressure to blow out gravel and mud alongside the driven rods. The phenomenon was never satisfactorily explained.

All substations are brought down to 15 ohms or less. In earlier practice the ground rods were driven close to the pole. All new rods are driven at a distance of about 5 ft. from the pole. No time is wasted in testing the old grounds placed close to the pole because experience has shown that they are invariably of high resistance.

A light panel truck is used for this work. It carries the following equipment and supplies for ground rodwork; 15 or 20 ground rods, Weaver ground rod clamps, posthole digger, sledge, shovel, pole tamp, digging bar, light chain hoists (to pull old rods), handline, rubber goods, No. 2 connectors, 100-lb. bag of salt, tape, lightning arresters, isolating gaps (for interconnected neutral installations).

No elaborate daily report is filed because the crew turns in its field book in which the test records are entered. From this the bill of material is taken for accounting purposes. All material is requisitioned from the storeroom. In this book are recorded rough sketches showing the location of multiple grounds installed at substations and at all distribution transformer locations. These sketches are transferred to drawings for office engineering reference purposes.

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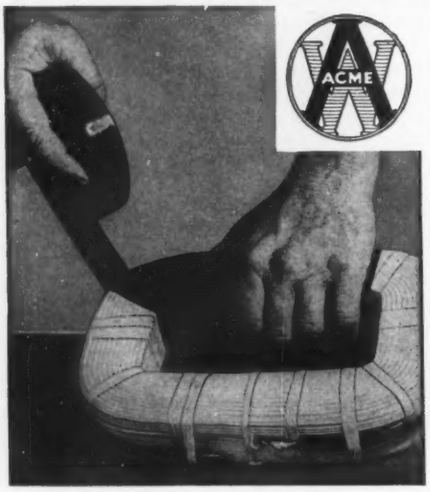
Bus & Cable Connectors
ASK FOR BULLETIN 38-D

TYPE "FR" Clamp Type Reducers

Cast to size interchangeable halves, DURONZE bolts and nuts. Rounded edges prevent conductor stress.

For connecting a smaller tubing to the end of a tubing bus. These connectors carry full rating of extra heavy tubing corresponding to the small end.

DELTA-STAR ELECTRIC CO.
2400 BLOCK CHICAGO, FULTON ST. ILLINOIS.



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THEY fit snugly into all corners and crevices. Their exceptional flexibility and tensile strength are due to an Acme developed process of applying pure vegetable oil varnishes of Acme formula to highest grade cotton fabrics. Offered in bias or straight tapes, and in rolls up to 36" wide —yellow or black. Samples if requested.

The Acme Wire Co., New Haven, Conn.

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For a Better Job at Lower Cost

Type SC-6X
For Small Wire Sizes

This Sherman "Wedge Grip" Solderless Connector is a natural. Use it for service and other wire connections. It speeds up the work and makes a permanent, dependable splice. Made of pure, hard copper. Non-removable bronze screw. Designed to provide extra wedging and snubbing action. Easier to tape. Write for FREE samples! Send for Bulletin #22.

Type SC-2X
For large wire sizes

H.B. Sherman MFG. CO.
Battle Creek, Mich.

Diesel Engine Operating and Outage Data

[*Continued from page 53*]

hours). Such an analysis (Table IV) shows that demand hours were only 47.3 per cent and idle hours 56.5 per cent of the summated hours considered for the aggregate of plants (*i.e.*, the period hours). Certain units were manifestly inactive, indicating that light-load conditions prevailed for at least part of the five-year period involved. This is further indicated by about 39 per cent of capacity in excess of the maximum-hour demand on the station aggregate. This situation also contributed to the low outage factor of 5 per cent because, with a sizable margin of capacity and certain idle units, there is less occasion to charge a unit with unavailability.

This influence of the number of units in a plant and particularly the excess capacity in the plant upon the service-demand-availability factor is indicated by the following abstract table:

Diesel Units in Demand	Diesel Units Reported (Engine-Years)	Service-Demand Availability Factor (Per Cent)
0 to 1,000	51	96.8
1,000 to 4,000	90	95.4
4,000 to 7,500	90	93.1
7,500 to 8,700	50	88.9

Of the total average outage of 435 hours, it appears that 315 hours were attributable to the engine, nine hours to the generators, ten hours to the auxiliaries and 101 hours to other causes. These 435 total outage hours were 10.5 per cent of the 4,120 average demand hours. Average outages per year per unit were 25, with an average duration of 17.4 hours each.

For the 212 engine-years reported in Table V the engine troubles account for 72.3 per cent of the total outage hours. Inspections accounted for 22.8 per cent of the outage time.

Specific causes of service unavailability of Diesel-generator plants are enumerated in Table VI. Main piston and piston ring troubles represent 13.2 per cent of total outage time, crankshaft difficulties 8.4 per cent (occurring on only ten machines, but consuming 737 average outage hours per machine), cylinder liners 4.2 per cent, crank and piston-pin bearings 5.7 per cent. The tabulated figures do not separate the outages experienced by two-cycle and four-cycle engines from one another. For this reason outage percentage of 2.3 for exhaust valve troubles (four-cycle engines) and the 1.0 per cent for scavenging pumps (two cycle engines) are both lower than they would appear if confined to their respective classes.

Data for complete overhaul of fifteen engines in 1936 and 1937 show that it required 728 hours per engine on the average to dismantle the machine and replace the parts found to be worn or defective.

Generators and Auxiliaries

Generator outages constituted a very small percentage of total outage time. Few inspections were reported specifically for the generators, but it can be inferred that they were examined while their engines were out of service for inspection or repair.

Water-cooling systems contributed 28.4 per cent of the outage time attributable to auxiliary equipment, exhaust systems 18 per cent, lubricating equipment 9.8 per cent, air compressor 8.4 per cent and fuel-oil equipment 2.2 per cent. Duplicate auxiliary equipment was available in most instances and consequently few instances of engine-generator outage were chargeable to unavailability of the auxiliary equipment.

Interlaced Bus Design Solves Space Problem

[*Continued from page 50*]

tives of the Westinghouse Electric & Manufacturing Company and the General Electric Company the design details of the terminals, clamps and supports were completed.

Both ends of the two 130-volt secondary coils are brought out through the transformer cover and terminate in 6 x 4 x 1⅛-in. laminated copper bars. This is done to obtain proper phase clearance and a suitable method of routing the leads to the respective phase bars distributed along the main bus section. All neutral coil ends are connected and grounded at the point where the interlaced bus connects to the customer's existing distribution bus. Here also the two coil ends of each transformer are connected to complete the usual parallel on the secondary. Nearly 7,000 sq.in. of contact surface on the bus and transformer connections are silver-plated to assure good conductivity.

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Recent Rate Changes

PENNSYLVANIA ELECTRIC CO., Johnstown, has reduced its rates to save consumers, other than industrial, a total of $406,300 a year, according to an announcement by the State Public Utility Commission. The new tariff is to be effective for all billings resulting from meter readings after September 30. The company on August 1, last, made effective a new rate for industrial customers which saves them $96,400 annually. On the basis of usage for the year ended June 30, 1940, the new rates effect the following reductions by classes of customers: residential, $319,700; commercial, $59,700; resale, $14,000 and street lighting, $12,900.

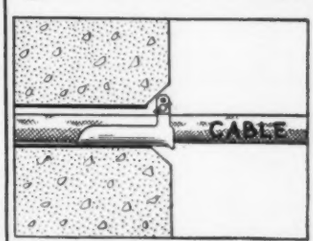
RENOVO EDISON LIGHT, HEAT & POWER CO. has agreed to a reduction in its rates which, based on consumer consumption data for the year ended December 31, 1939, will save consumers approximately $9,994, as the result of negotiations with the Pennsylvania Public Utility Commission. The new tariff schedules are to be effective for all billings resulting from meter readings after September 30. In view of the reduction, the commission is of the opinion that the public interest does not require further prosecution of its rate case against the company. The company proposes to distribute the total reduction in the following manner: residential lighting, $5,299; commercial lighting, $3,779; power service, $711, and refrigeration service, $205.

TICONDEROGA ELECTRIC LIGHT & POWER CO. has been granted permission by the New York Public Service Commission to put into effect revised rates which will save electric consumers approximately $4,500 per annum. The new rates became effective as of September 15. The filing revises residential and all-purpose rates. All customers using more than the minimum will receive reductions. The initial charge of $1 per month with an allowance of 10 kw.-hr. remains as in the old rate.

VILLAGE OF SOLVAY, N. Y., which operates a municipal electric plant, has been authorized by the state Public Service Commission to put into effect revised rates which will reduce its revenues $5,250 per annum. Of this amount, $3,250 will be reduced to residential and commercial customers and $2,000 in street lighting rates to a lighting district outside of Solvay. The new charges became effective as of September 15.

STAPUT FAIRLEADERS

Save Your Cables



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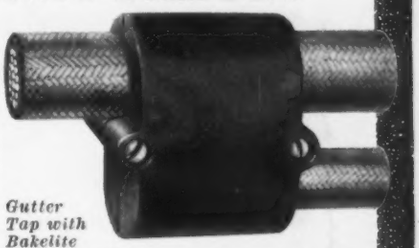

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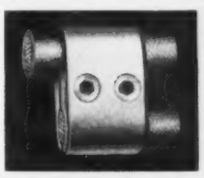

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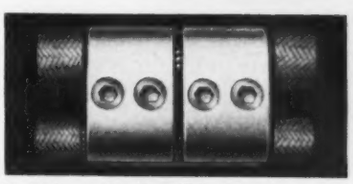

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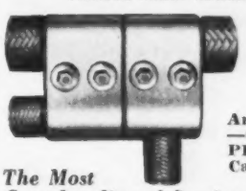

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3	50	GE	2300	220/440
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(Continued on opposite page)